CANMET

REPORT 83-20E

Canada Centre for Mineral and Energy Technology

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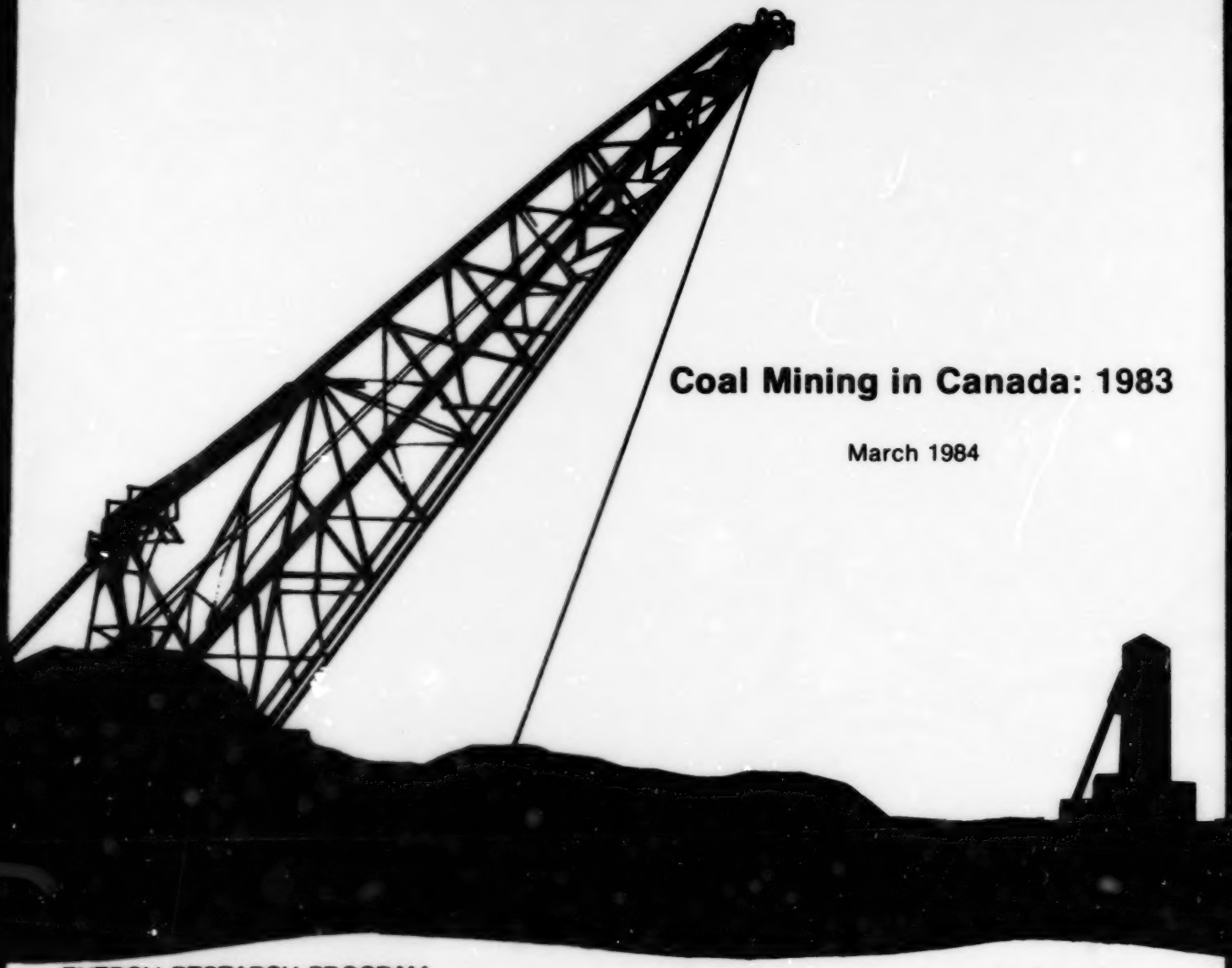

Coal Mining in Canada: 1983

March 1984

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COAL RESEARCH LABORATORIES

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Canada

UNITS OF MEASUREMENT

Units of measurement in this report are in the International System of Units (SI) as approved for official use by the Canadian Standards Association and Metric Commission Canada. These units have been adopted by the Mining Association of Canada and the Coal Association of Canada. To assist with the shift to metric units these two associations have published "Metric Practice Guide for the Canadian Mining and Metallurgical Industries", 1978.

Following are some useful conversion factors along with SI prefixes.

Multiply this		by this	to obtain	
British thermal unit (Btu)		1055.06	joule	J
Btu per pound		2.326	kilojoule per kilogram	kJ/kg
cubic yard		0.764 555	cubic metre	m^3
cubic yards per ton		0.842 78	cubic metres per tonne	m^3/t
foot		0.304 8	metre	m
joule	J	0.000 947 8	Btu	
kilojoule per kilogram	kJ/kg	0.429 923	Btu per pound	
kilometre	km	0.621 371	mile	
litre per second	L/s	13.1982	gallon per minute	
megajoule per kilogram	MJ/kg	429.923	Btu per pound	
metre	m	3.280 84	foot	
mile		1.609 344	kilometre	km
short tonne per acre foot		7.354 67	tonne per hectare metre	t/ham
ton (long)		1.016 046 9	tonne	t
ton (short)		0.907 184 7	tonne	t
tonne		0.984 206 5	long ton	
tonne		1.102 311	short ton	

SI PREFIXES

Multiplying Factor	Prefix	Symbol
1 000 000 000 000 000 000 = 10^{18}	exa	E
1 000 000 000 000 000 = 10^{15}	peta	P
1 000 000 000 000 = 10^{12}	tera	T
1 000 000 000 = 10^{9}	giga	G
1 000 000 = 10^{6}	mega	M
1 000 = 10^{3}	kilo	k
100 = 10^{2}	hecto	h
10 = 10^{1}	deca	da

COAL MINING IN CANADA: 1983

by

A. S. Romaniuk and H. G. Naidu

CANMET REPORT 83-20E

March, 1984

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FOREWORD

There is a continuing need by industry engineers, market researchers and government officials for a publication that lists significant operational and technical information about the Canadian coal mining industry. The staff of the Coal Research Laboratories have assembled a substantial base of information on these and related subjects during the course of their work on CANMET's Coal Reserves and Production Project. The presentation of the data in this report will enhance the national and international dissemination of this information in a format which facilitates periodic updating and current technology review.

There is a link between the data supplied in this report and that provided in the former EMR publication "Operators List 4: Coal Mines in Canada", last published in January 1979. Coal production data, producer's disposition of coal and numbers of persons employed covering the period 1979 to 1983 are included for purposes of statistical continuity. In addition this report updates Canada's coal reserves to 1982, presents a brief sketch of the geological setting for mining operations and presents data representative of coal qualities mined in Canada's major coalfields.

T.D. Brown
Director
Coal Research Laboratories

ABSTRACT

COAL MINING IN CANADA: 1983

by

A.S. Romaniuk* and H.G. Naidu**

This report has two purposes: to present significant information on coal mining operations in Canada as of December 1983 and to update the assessment of Canada's coal reserves as of December 1982.

Regarding coal mining operations the report includes names of operators, location and size of operations, a brief description of mining and coal preparation methods and major equipment used. Because the geological setting of coal operations in Canada varies in the extreme and because this setting is critical to the technology used in excavating and processing coal, a section briefly depicting the geology of major coalfields has been included.

Canada's coal reserve quantities have been updated from those presented in EMR Report ER 79-9 because of significant changes that occurred since 1978, especially in Nova Scotia, Alberta and British Columbia. Coal quality data have likewise been updated. EMR's reserve term definitions are unchanged from the earlier report, except the term COAL-IN-MINEABLE-SEAMS replaces the earlier term "mineable coal".

The approval of coal projects in Alberta and British Columbia follows well-defined procedures. This has resulted in some public disclosure of data on coal reserve quantities, limiting criteria, coal quality, mining plans, environmental impact assessments etc. Technological information used in this report was also acquired during regular visits by Coal Research Laboratories staff to operating mine sites across Canada.

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INTRODUCTION

This report is linked to two previous series of publications produced by Energy, Mines and Resources (EMR). One was an annual series entitled "Operators List 4: Coal Mines in Canada", the last issue of which was produced by the Energy Sector in January, 1979. The other series (1,2) was concerned with the assessment of Canada's coal resources and reserves. The last assessment was presented in Report ER 79-9 "Coal Resources and Reserves of Canada" dated December, 1979. This was a combined effort of the Geological Survey of Canada, the Energy Sector and CANMET, whose contribution covered coal reserves and coal quality.

Like the former "Operators List 4: Coal Mines in Canada" this publication includes information on mine locations, operating officials, numbers of employees, mining and coal preparation methodology, major equipment and production statistics. As such, it should be a useful public reference work for research planners, industrial engineers, suppliers of equipment and services and perhaps potential buyers and sellers of Canadian coal. More details on individual mine operations should, of course, be directed to the mine operators.

The up-date on Canada's coal reserves, by province and by coalfield, has been included because significant tonnages of coal reserves have been added as a result of new mine developments between 1978 and 1982. The EMR definitions for coal reserve terms, as presented in Report ER 79-9, have been used in this report.

Most of the information and data presented has been gathered as a result of staff working on CANMET's Coal Reserves and Production Project. This includes regular visits to coal mining operations across Canada and liaison with provincial officials concerned with regulating coal operations.

GEOLOGICAL SETTING: MAJOR COALFIELDS IN CANADA

(Figures 3 to 6 show locations)

Nova scotia

SYDNEY COALFIELD: This is by far the most important in the province and contains eleven major seams, ranging in thickness from 1.0 to 4.5 m. Six seams are considered economically important but only two are currently being mined, namely the Harbour Seam (also referred to as Sydney Main) and the Hub Seam (also called Stubbert Seam). Coal is Pennsylvanian in age, classed as high volatile "A" bituminous, is generally low in ash when mined underground, and high in sulphur. Almost all Sydney Coalfield reserves are submarine.

The seams are separated by consistent intervals of rock strata composed of sandstone, siltstone, mudstone, shale and limestone, suggesting deposition in a fluvial environment within a subsiding coastal plain. The coal has not been significantly disturbed on a regional structural scale. Strata are enclosed in a series of open folds which give rise to open synclinal and anticlinal structures whose effect is to vary the dip of beds from 3° to 15°, all in a seaward direction. Seams are often split by shale and sandstone partings. The coal is considered gassy, especially the Harbour Seam. Roof conditions are variable for the same seam in different areas of the coalfield.

New Brunswick

MINTO COALFIELD: This coalfield, located in central New Brunswick, covers an area of approximately 32 km by 13 km along the northern end of Grand Lake. Production comes from a single seam, classed as high volatile "A" bituminous coal, Pennsylvanian in

age, varying in thickness from 0.3 to 0.7 m but for the most part ranging from 0.4 to 0.6 m. The seam is essentially flat-lying with minor undulations. Large sections of it follow surface contours, making it amenable to surface mining. The thicker part of the coal is found in the southwest (Minto) area, rather than the northeast (Chipman) area. A shale band in certain areas splits the coal seam.

Ontario

A thin, Lower Cretaceous sequence called the Mattagami Formation underlies the southern part of the Moose River Basin which lies adjacent to the Canadian Shield of northern Ontario. The sequence consists of sandstone, clays and lignitic coal and the area underlain by it is known as the Onakawana Coalfield. Currently there are no prospects for developing this resource of high moisture lignitic coal which has been delineated over an area of about 39 km^2.

Saskatchewan

ESTEVAN COALFIELD: The coal resources of southern Saskatchewan, including those of the Estevan Coalfield, have been the subject of a major study and report (3) and readers are referred to this report for details on regional and local geology. Briefly, the Estevan Coalfield is the most easterly the most developed of four coal regions stretching across southern Saskatchewan, all of which are within the Ravenscrag Formation. The Ravenscrag in the Estevan area is a syncline plunging gently to the sou heast at about 4.7 m per km. The major part of this coal-bearing formation extends into the states of North Dakota, Montana and Wyoming, where it is correlated with the Fort Union Group. Estevan coal is classified as lignite "A" and is Tertiary in age.

Because of the tendency for individual seams in the Ravenscrag to thicken, thin, split or disappear correlation has been more practical when done by coal zone rather than by individual seam. Five such zones have been identified for the Estevan Coalfield. From top to bottom these are: Short Creek, Roche Percée, Souris, Estevan and Boundary. Zones vary in their areal coverage. For example, the Short Creek Zone covers an area of about 88 km^2 whereas that of the Estevan Zone covers about 442 km^2. As well, glacial and preglacial erosion has removed extensive sections of various zones, replacing coal seams with sand and gravel. Nowhere in this coalfield is more than one coal zone being mined, either because other zones are missing or because overburden is too thick for mining by surface methods under current economic conditions.

The topography of the Estevan Coalfield is relatively flat, with the exception of the valleys of the Souris River and its tributaries, Short Creek and Long Creek, which have cut the plain to a depth of about 30 m.

WILLOW BUNCH COALFIELD: Willow Bunch coals are separated from those of the Estevan Coalfield to the east by an area of thick glacial overburden and barren beds of the Ravenscrag Formation. To the west there appears to be a belt where no coal was deposited and which separates Willow Bunch from the Wood Mountain Coalfield. The Willow Bunch Coalfield is subdivided into Willow Bunch East and Willow Bunch West by the barren Roncott Platform (3).

Six coal zones have been identified in the Willow Bunch Coalfield. Because of the dissected topography and regional geological structure all zones are present at shallow depth in limited areas within the coalfield. Mine development is currently underway in the southwest part of the coalfield, near Coronach, with coal classed as lignite "A" being mined from the Hart Zone.

Alberta's Plains Region

This region extends north from the international border with Montana to Lesser Slave Lake, and is bounded on the west by the Foothills Region which parallels the Rocky Mountains. Within this extensive region are four principal coal-bearing units which occur at relatively shallow depth, namely:

- in southern Alberta: Oldman and Foremost Formations (making up the Belly River Group); Upper Cretaceous in age.
- in southern and central Alberta: Horseshoe Canyon Formation; Upper Cretaceous
- in north central Alberta: Wapiti Formation; Upper Cretaceous/Tertiary
- in western Alberta, parallel to the Foothills: Paskapoo Formation; Upper Cretaceous/Tertiary.

Northwest of Edmonton the Horseshoe Canyon Formation merges into the Wapiti Formation. Coal in the formations is almost entirely subbituminous in rank. As in southern Saskatchewan, lateral continuity of individual seams is variable, but coal zones are generally persistent over large areas. Individual zones often contain several seams.

BATTLE RIVER COALFIELD: This coalfield, part of the Horseshoe Canyon Formation, has a coal zone made up of up to 3 seams aggregating 3.6 m in thickness with partings also aggregating 3.6 m. Regional dip is about 3 m per km in a west and southwest direction.

WABAMUN COALFIELD: The most economically significant coal zone in this coalfield is the extensive Lower Ardley unit which is part of the Scollard Member of the Paskapoo Formation. The Lower Ardley, from subcrop to a depth of 300 m covers an area of roughly 1 600 000 hec and stretches from Three Hills to Whitecourt, a distance of 300 km. Wabamun coal is Upper Cretaceous in age and is classed as subbituminous B. The coal zone is nearly horizontal, dipping to the southwest about 4.2 m per km with local variations as high as 12.3 m per km and as low as 1.9 m per km.

In a coal zone of thickness ranging between 9 and 11 m there are up to six seams with average cumulative coal thickness from 7 to 8.5 m. Most coal comes from two seams each 3.0 m thick with a parting of 1.4 to 1.7 m. Overlying the coal is a burden currently averaging about 20 m thick, which is expected to reach up to 60 m as mining proceeds. Overburden consists of soft glacial till underlain by weakly consolidated shales, siltstones and sandstones. The surface-mined coal seams in the Alberta plains are almost always the hardest units in the stratigraphic succession and at some mines the coal is drilled and blasted before being excavated.

Alberta's Foothills Region

COALSPUR COALFIELD: Coal measures in this coalfield are underlain by a succession of non-marine sediments of Upper Cretaceous and Paleocene ages ranging in thickness from 1 500 to 2 100 m. Five seams of commercial interest are contained in a stratigraphic section some 210 m thick. Three of these are currently being mined, namely Mynheer, Upper Silkstone and Val D'Or. Coal rank is high volatile bituminous.

In the vicinity of the Coal Valley Mine the Mynheer Seam, which is located at the base of the coal measures, ranges from 5 m to 10 m in thickness and has many bentonitic and shale partings. The Silkstone Seam, split in places by 3.0 to 6.0 m of sandstone and siltstone, lies some 45 m above the Mynheer. The Upper Silkstone is from 2.4 to 3.7 m thick with clay partings while the Lower Silkstone has 0.7 m of coal. The Val D'Or Seam has up to 10 m of coal with

up to six partings the largest of which is sandstone up to 3.5 m thick.

The Coal Valley area is in the structurally deformed Foothills Region of Western Alberta. The Laramide Orogeny, the early phase of which began in the Upper Cretaceous and the late phase ended probably in the Oligocene, initiated compression and tension stresses from the southwest. Thrust faults have caused the repetition of measures and hence the areal concentration of coal. Severe secondary faulting in coal seams has created complex structures.

Alberta's Mountain Region

CADOMIN-LUSCAR COALFIELD: Coal measures occur within the Luscar Formation which is Lower Cretaceous in age. This formation, some 435 m thick, has one major seam of commercial importance, the Jewel Seam, which occurs roughly in the middle of the formation.

The Jewel Seam has a true thickness of 8 to 10 m but, because of structural thickening, can be up to 30 m. Coal is generally clean and free of partings. Coal rank is low to medium volatile bituminous.

Being part of the Rocky Mountains, coal measures have been deformed by the Laramide Orogeny. This geological deformation typically produces coals which are friable and further degrade in size when treated in coal preparation plants.

SMOKY RIVER COALFIELD: Coal seams in this coalfield are within the lower part of the Luscar Formation and are of Lower Cretaceous age. Eleven coal seams ranging in thickness from 0.6 to 7.9 m have been identified. Three of these (numbered from the bottom up) are currently being mined by surface and underground methods, namely No. 4 Seam which averages 6.1 m, No. 10 Seam which is 2.7 m and No. 11 Seam which is 3.0 m thick. The others are generally too thin and discontinuous to be economically recovered. Rock units are made up of interbedded, discontinuous sandstones, siltstones and shales which are difficult to correlate because of the absence of marker horizons other than the coal seams.

The regional geology is similar to that described for Alberta's Foothills Region. Strata are in a northwesterly trending sequence of assymetrical folds cut by thrust faults which dip to the southwest. Mining areas are limited to a flat-bottomed syncline and to the limbs of shallow dipping folds. Locally low-angle thrust faults, joint sets and the coal cleat can create difficult roof conditions underground or planes of weakness in pit walls.

Coal mined in the Smoky River Coalfield is high quality metallurgical coal, classified as low volatile bituminous.

British Columbia

CROWSNEST COALFIELD: Located in the southeast corner of the province this coalfield historically and currently is one of Canada's most important. Coal occurs in multiple seams within the Kootenay Formation which is of Lower Cretaceous (Upper Jurassic?) age.The Kootenay is some 730 m thick and contains fourteen seams of economic significance in the vicinity of the Westar Mining Ltd. operations. One seam referred to as 10 Seam is about 11 m thick and provides the bulk of coal production from both surface and underground mining operations.

Thrust faulting and tight folding - part of the uplifting and tectonic action which created the Rocky Mountains - have produced seam repetitions and local structural thickening. In certain parts of the coalfield these same conditions have caused seams to be eroded or rendered unmineable.

Coal rank ranges from low to medium volatile bituminous.

ELK VALLEY COALFIELD: Located north of the Crowsnest Coalfield the Elk Valley Coalfield is also of major economic significance as a source of high grade metallurgical and thermal coals for the export market.

Coal seams fall within the Kootenay Formation which is of Lower Cretaceous (Upper Jurassic?) age and range upward in the sequence from low volatile to high volatile, although most of the coal is on the low to medium bituminous boundary. In the vicinity of the Fording River Mine up to eleven seams are mined each with thickness between 1.5 m and some 20 m for an aggregate thickness of 65 m. The formation thickness is about 450 m. At the Greenhills Mine, located 10 km south, twenty-nine seams have been identified with the bulk of production coming from four of these which range in thickness from 5 to 16 m. At the Line Creek Mine, near the south end of the coalfield, seven seams are mineable, ranging in thickness from 3 to 13 m, with the bulk of low and medium volatile coal being produced from four of these.

Structural conditions vary considerably within the coalfield, but mining generally takes place within synclines or on limbs of synclines.

PEACE RIVER COALFIELD: This coalfield is located in the Rocky Mountain foothills of north-eastern British Columbia. It is within the northwest trending fold belt which is characterized by southwest dipping thrust faults whose effect is to repeat coal measures, thereby adding to the quantity of coal in a given area. Two mines have recently commenced production in this coalfield: the Quintette Mine of Denison Mines Ltd. and the Bullmoose Mine of Teck Corporation. The description which follows refers to the former, which is the larger of the two.

Within the Quintette lease area the more economically significant coal measures occur within the Gates Member of the Commotion Formation which is part of the Fort St. John Group of Lower Cretaceous (Upper Jurassic?) strata. Of less economic significance are the coal measures of the Gething Formation whose base is some 200 to 400 m below the Commotion.

Two areas have been identified for mine development. In one area there are six persistent coal zones located within a shallow syncline whose limits dip up to 10%, and which plunges from 6° and 8° to the southwest (although the regional folds are northwest). To the northeast the pit is bounded by a south-westerly dipping zone of thrust faulting. Coal seams in this area, which contain about 45% of the recoverable coal reserves for the Quintette Mine, have an aggregate thickness in excess of 18 m within a 90 m section of predominantly shale and siltstone. In the other area four or five seams with an aggregate thickness of 18 m have been identified. This structure consists of two contiguous synclines with limbs dipping from 15° to 30°. A south-westerly dipping thrust fault forms a mining limit on all but the south-eastern corner of the deposit.

Coal rank is medium volatile bituminous.

CLASSIFICATION OF COAL BY RANK

Canada uses the systems and procedures of the American Society for Testing and Materials (ASTM) for sampling, analysing and classifying coals by rank, as detailed in the Annual Book of ASTM Standards (4). Basically coals are ranked according to their degree of metamorphism, or progressive alteration, in the natural series from lignite to anthracite.

Classification in the ASTM system is a function of fixed carbon content

VM%*	FC%*	CLASS	GROUP	CALORIFIC VALUE **	
				Btu per lb	Mj/kg
2	98	ANTHRACITIC(1)	META - ANTHRACITE		
8	92		ANTHRACITE		
14	86		SEMIANTHRACITE		
22	78	BITUMINOUS(2)	LOW VOLATILE BITUMINOUS		
31	69		MEDIUM VOLATILE BITUMINOUS		
			HIGH VOLATILE A BITUMINOUS	14 000	32.6
			HIGH VOLATILE B BITUMINOUS	13 000	30.2
			HIGH VOLATILE C BITUMINOUS	11 500	26.7
		SUBBITUMINOUS(4)	SUBBITUMINOUS A(3)	10 500	24.4
			SUBBITUMINOUS B	9 500	22.1
			SUBBITUMINOUS C	8 300	19.3
		LIGNITIC(4)	LIGNITE A	6 300	14.7
			LIGNITE B		

* Dry, mineral-matter-free basis
** Moist, mineral-matter-free basis
(1) Non-agglomerating; if agglomerating classified as low volatile bituminous
(2) Commonly agglomerating
(3) If agglomerating classified as high volatile C bituminous
(4) Non-agglomerating
VM: Volatile matter
FC: Fixed carbon

Figure 1 - Summarized classification of coal by rank (after Report ER 79-9)

and calorific value calculated on the mineral-matter-free basis. The higher rank coals are classified according to fixed carbon on the dry basis whereas the lower-rank coals are classed according to calorific value on the moist basis. The agglomerating characteristics of coals (i.e. their binding and/or swelling qualities when heated in the absence of oxygen) are used to differentiate between certain adjacent groups in the ranking. Figure 1 summarizes the ASTM classification of coal by rank.

The approved abbreviations (4) of the ranks of coal by group are noted below:

ma = meta-anthracite
an = anthracite
sa = semianthracite
lvb = low volatile bituminous
mvb = medium volatile bituminous
hvAb = high volatile A bituminous
hvBb = high volatile B bituminous
hvCb = high volatile C bituminous
subA = subbituminous A
subB = subbituminous B
subC = subbituminous C
ligA = lignite A
ligB = lignite B

The proximate analysis of coal (and coke) by definition (4) is the assay of the moisture, ash and volatile matter and the calculation of fixed carbon by difference. In other words % fixed carbon = 100 - (% moisture + % ash + % volatile matter), with all percentages on the same moisture reference base. Other constituents such as sulphur and phosphorus are not included with proximate analysis.

The term ultimate analysis as applied to coal (and coke) is by definition (4) the determination of carbon and hydrogen in the material, as found in the gaseous products of its complete combustion, the determination of sulphur, nitrogen, and ash in the material as a whole, and the calculation of oxygen by difference. The determination of phosphorus or chlorine is not a part of the ultimate analysis of coal. Moisture is not a part of the ultimate analysis of coal but must be determined in order that analytical data may be connected to bases other than that of the analysis sample. As some coals contain mineral carbonates, and practically all coals contain clay or shale which in turn contains combined water, a part of the carbon, hydrogen, and oxygen found in the products of combustion may arise from these mineral components.

The Free-Swelling Index (FSI) of coal is a number ranging from 1 to 9 based on a small-scale test of the free-swelling properties of coal. The results may be used as an indication of the caking characteristic of the coal when burned as a fuel, and hence is an indicator of the coals suitability for coke-making purposes. Basically, the test involves a one-gram sample being heated in a covered crucible and the resulting coke button's profile being compared with the series of standard profiles shown in Fig. 2.

QUALITY CHARACTERISTICS OF COAL IN CANADA

All ranks of coal occur in Canada, although no anthracitic coals have been produced since the closure in 1979 of the Canmore Mines, located at the eastern entrance to Banff National Park. Besides this wide range in rank, it is worth noting that coals of the same rank, but from different regions, can vary significantly when quality characteristics are compared. For example, much of the high volatile bituminous coal from the Sydney Coalfield in Nova Scotia is an agglomerating coal, relatively high in sulphur and low in ash. The same rank of coal from the Coalspur Coalfield in

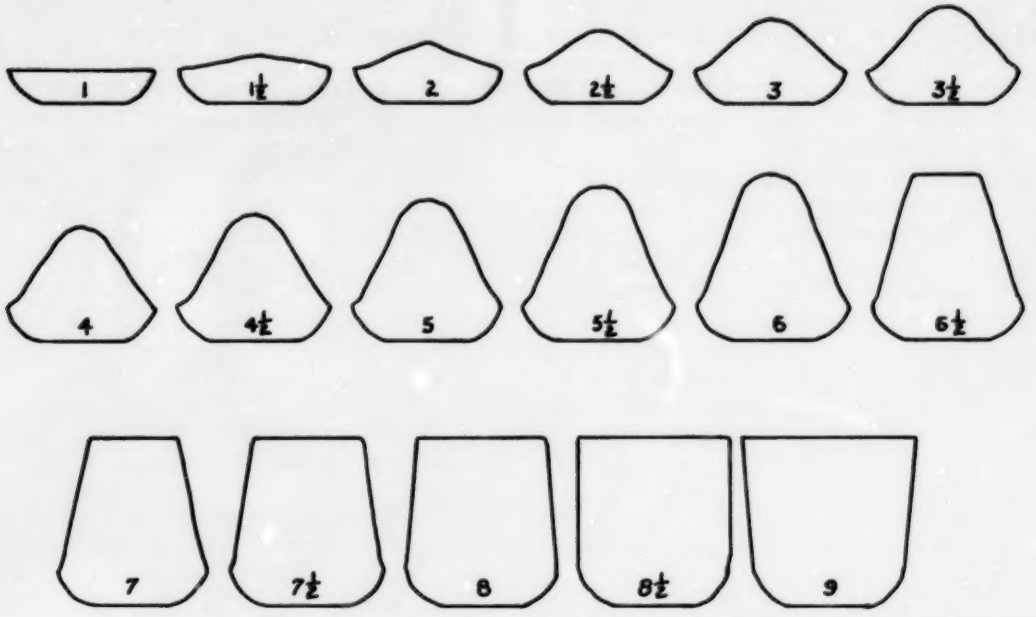

Figure 2 - Full-scale standard profiles and corresponding Free-Swelling Index (FSI) numbers, after reference (4)

Alberta's Foothills is non-agglomerating, low in sulphur and high in ash. Table 1 summarizes the salient quality characteristics of coal in the major coalfields or coal regions of Canada.

CANADA'S COAL RESERVES: AN UPDATE

Resource and Reserve Terminology:

This report like its predecessors (1,2) attempts to provide some answers to the question of national coal supply as expressed in the deceptively simple phrase ..."how much coal, of what quality, can be recovered where and when in Canada, and at what relative cost"...

Before defining the coal reserve terms used in this report it may be worthwhile to examine the two facets or dimensions implicit in the word "reserve", namely,

- geological assurance of existence
- technical/economic feasibility of exploitation

For a judgment of feasibility of exploitation, it is also necessary to consider producion rate/timing, which can be viewed as the link between reserves and supply.

Readers are referred to a report by Zwartendyk (5) on the pitfalls which commonly accompany the mental exercise of converting an in-place mineral deposit to a saleable mineral

commodity which then represents part of supply. Following are the various dimensions to this exercise, beginning with resource terminology, because coal reserves are derived from the resource base.

The descriptor MEASURED is preferred within the Department of Energy, Mines and Resources (EMR), to designate those coal resources whose geological existence is most assured. Ideally, this assurance would be quantified and expressed as a kriging variance or as a percentage error which in turn would convert to a range for estimated tonnages. However, this geostatistical approach requires data bases and methodology which, with the exception of the SASCO file (3) and a few smaller data bases, are still under development. The alternative is to link terms such as MEASURED and INDICATED to certain maximum distances between reference points (usually boreholes) as was done in Report ER 79-9, for each of the major physiographic regions in Canada where coal is being mined. These distances are given in Appendix "A".

This report purposely omits any reference to coal whose confidence level is at the low end of the descriptor scale, namely "inferred" or "speculative", because such coal does not enter the foreseeable coal supply picture. Consideration of such resources would detract from one of the objectives for this report which is to identify coal already discovered in terms which are understood, rather than speculate on coal deposits which have yet to be discovered.

Once a coal deposit's tonnage is reasonably well assured the next dimension to be considered is the technical/economic feasibility of its exploitation. The usual way of assessing this facet is the production feasibility study which includes the identification of the specific mining method and production rate, a flow sheet for the coal preparation plant (assuming the coal will be beneficiated), saleable coal quality characteristics, the environmental impact assessment, manpower needs, and needs for power, water, surface plant, transportation, housing, etc. Taxes and royalties must likewise be considered in this feasibility study. The subject of project feasibility would be incomplete without mentioning one important assumption about its future, namely the assumption that markets at acceptable prices will exist for all the saleable product. This can be restated as an assumption that prices will generally remain above costs for the time period the coal deposit is being considered for production.

Production feasibility studies are required by provincial government regulatory agencies in Alberta and British Columbia before approval-in-principle is given either to new coal projects or to major expansions of existing operations. These feasibility reports, or reports produced by the regulatory agency in support of its decisions, become public documents, when approved, and are therefore an important source of data on coal reserve quantities, limiting criteria, representative coal qualities, mining methods, etc. Established mine operators usually undertake their own feasibility studies to derive coal reserves for the continuing operation of their mines.

Without the production feasibility study it is easy to stray into that grey area, also referred to as the "argument zone", into which national reserve assessment reports have been known to disappear, only to reappear later, with reserve quantities reduced by an order of magnitude.

Other important considerations are the rate and timing of production. Policy makers, coal producers, coal buyers and coal transporters are

TABLE 1 — QUALITY CHARACTERISTICS OF

Region/Coalfield	Rank	Current Use (potential use)		Proximate Analysis % 1 run-of-mine coal 2 clean coal M	A	VM	FC
NOVA SCOTIA							
Sydney Coalfield	hvb	75% thermal	1	5-8	15-25	30-35	40-50
		25% metallurgical	2	2-8	3-12	29-35	54-62
NEW BRUNSWICK							
Minto Coalfield	hvb	thermal	1	1-3	15-23	32-36	46-50
SASKATCHEWAN							
Estevan Coalfield	lig	thermal	1	30-35	6-13	26-31	29-32
Willow Bunch Coalfield	lig	thermal	1	36-40	10-13	23-26	26-28
ALBERTA PLAINS							
Battle River Coalfield	sub	thermal	1	23-25	6-12	29-34	35-38
Lethbridge Coalfield	sub-hvb	(thermal)	1	9.5	10-20	35.5	36-44
Sheerness Coalfield	sub	thermal	1	24-27	8-15	27-30	34-37
South Swan Hills Coalfield	sub	(thermal, chemical feedstock)	1	22-24	21-22	24-26	30-31
Wabamun Coalfield	sub	thermal	1	19-21	10-20	26-29	31-40
Wetaskiwin Coalfield	sub	(thermal)	1	18-20	13-16	27-28	36-38
ALBERTA FOOTHILLS							
Coalspur Coalfield	hvb	thermal	1	9-11	22-25	27-28	37-42
			2	8.5-9.5	8-10	33	49
Obed Marsh Coalfield	hvb	(thermal, chemical feedstock)	1	16-20	30-31	33	20
			2	7-8	12-13	36	44
ALBERTA MOUNTAINS							
Cadomin Luscar Coalfield	mvb	metallurgical (thermal)	1	1-3	12-20	18-20	55-60
			2	7	10	20-22	58-65
Smoky River Coalfield	lvb	metallurgical and some thermal	1	4	17-20	16	60-63
			2	6	7-8	17-18	65-69
BRITISH COLUMBIA							
Comox Coalfield	hvb	(thermal)	1	6	15.8	32.7	45.5
Crowsnest Coalfield	lvb-mvb	metallurgical and thermal	1	4-5	15-20	19-23	55-60
			2	7-8	9-10	20-22	59-61
Elk Valley Coalfield	lvb-mvb -hvb	metallurgical and some thermal	1	3-5	20-35	19-33	40-60
			2	8	6.5-10	21-34	50-64
Flathead Coalfield	mvb	(thermal) metallurgical)	1	3-6	25-35	22	40-50
Hat Creek Coalfield	lig-sub	(thermal, chemical feedstock)	1	23	32	24	21
Peace River Coalfield	mvb	metallurgical and thermal	1	6	20-30	21-27	45-55
			2	6-8	7-10	22-24	65-68
			2	8	10	23	65-66

Abbreviations used for rank: lig = lignitic; sub = subbituminous; hvb = high volatile bituminous; mvb = medium volatile bituminous; lvb = low volatile bituminous
Abbreviations used for proximate analysis: M = moisture, A = ash; VM = volatile matter; FC = fixed carbon

COAL IN CANADA, BY REGION AND COALFIELD

Sulphur %	Heating Value (moist basis) MJ/kg	Remarks
1-4	24-31	low ash, variable sulphur, high
1-2.5	29-33	reactivity; FSI of clean met. coal:7½
6-10	26-28	high sulphur, high ash
0.4-0.6	14-17	
0.5	12-14	high moisture
0.3-0.5	18-20	
0.5-0.6	21-24	
0.4-0.5	17-19	variable ash
0.3	15-16	
0.2-0.4	16-19	variable ash
0.2-0.4	19-20	
0.2-0.4	20-22	variable quality; clay bands in
0.3	26	coal demand selective mining
0.5	19	
0.5	20	
0.2-0.3	25-30	
0.2-0.3	30-32	FSI: 5 to 7
0.4	28	
0.4	33-34	FSI: 7to 9
1.1	26	composite from 3 seams in Quinsam Project
0.3-0.4	30-31	clean thermal coal has higher ash
0.2-0.4	31-33	FSI: 6½ to 7 in clean met. coal
0.3-0.5	20-25	several blends of clean coal are
0.3-0.5	30-37	produced
0.5	20-25	% VM is an average value
0.4	11.6	values shown are average for a highly variable coal
0.3-0.5	21-26	
0.3-0.5	33-36	clean metallurgical coal
0.3-0.5	29-32	clean thermal coal

becoming increasingly concerned not only with the "how much" but also the "when" aspects of the coal supply question, especially in times of increasing competition from other suppliers abroad or from other competing energy commodities. Feasibility studies on Canadian bituminous coals destined for the export or domestic market normally cover a time span of fifteen years, which is the usual time span for long-term supply contracts. Lower rank coal deposits destined for local power generation plants are evaluated for a thirty year time span as this is the usual time span considered reasonable to write off the capital cost of a power generating plant.

Turning now to coal reserve terminology, this report introduces one change to the terms used in Report ER 79-9. The term "mineable coal" used previously has been replaced with COAL IN MINEABLE SEAMS, because the former term tends to be confused with RECOVERABLE COAL. The term SALEABLE COAL is clear and broadly accepted. Thus, the reserve terms used to describe the mental exercise of converting a coal deposit into a saleable product can be summarized as follows:

In Report ER 79-9	
MINEABLE COAL	Level 1
RECOVERABLE COAL	Level 2
CLEAN COAL	Level 3
SALEABLE COAL	Level 4

This Report	
COAL IN MINEABLE SEAMS	Level 1
RECOVERABLE COAL	Level 2
CLEAN COAL	Level 3
SALEABLE COAL	Level 4

Definitions of the reserve terms used in this report are given in Appendix "B".

Before leaving the subject of coal reserve terminology it is worth noting that coal actually covers a wide range of commodities of different compositions, uses and values, unlike virtually any other mineral commodity. Coal spans the continuum from peat to anthracite. One tonne of saleable bituminous coal can be worth several times that of one tonne of saleable subbituminous coal. In time, coal reserve assessments should provide answers to questions of supply for different markets, including:

- metallurgical coal market, both domestic and export
- thermal coal market, both domestic and export
- mine-mouth power generating market
- chemical feedstock market, including coal conversion to gaseous and liquid hydrocarbons.

Coal Reserves by Province/Coal Region Coalfield

Coal reserve quantities listed in Table 2 fit the definition of coal reserves stated in Appendix "B". These quantities are part of the COAL RESOURCES OF IMMEDIATE INTEREST defined in Appendix "A", except for the resource numbers given for Alberta for reasons which are given in the next paragraphs. Only those coal resources which fall within the MEASURED and INDICATED categories have been presented. Those resources whose geological assurance of existence categorizes them as INFERRED have been excluded, in line with the definitions given in Appendices "A" and "B", as have RESOURCES OF FUTURE INTEREST.

Alberta's coal resources and reserves are assessed by its Energy Resources Conservation Board (ERCB) and are reported annually (6). However, ERCB's criteria and procedures

for defining resources differ from those used by Energy, Mines and Resources and a direct correlation between the two systems is not possible. However, there appears to be a reasonable correlation between EMR's definition of reserves and ERCB's "mine permit reserves" for reasons which follow.

Developers wishing to mine coal in Alberta must first obtain a permit and license from ERCB. An application for a permit must contain extensive site-specific information on in-situ coal quantities, coal quality, proposed mining methods, marketing of coal, etc. This may be considered the equivalent to an engineering feasibility study. Accordingly, that part of ERCB's mine permit reserves referred to (6) as coal "remaining in place" has been considered equivalent to EMR's COAL IN MINEABLE SEAMS and ERCB's "reserves of raw coal" has been considered equivalent to EMR's "RECOVERABLE COAL". These equivalents have been used in Table 2 for reserves in coalfields in the Province of Alberta.

Coal Reserves by Rank

Tonnage figures for British Columbia and for Canada as a whole have purposely not been totalled, because such summations would include coal of various ranks which, when lumped together, give a number with little meaning for supply purposes. Totals can more usefully be expressed in terms of heating value, as shown in Table 3. Coal deposits with less than 2 megatonnes recoverable coal have been excluded from this table.

Coal Reserves by Likely Mining Method

The mining methods identified for individual coal deposits in engineering feasibility studies are presented in Table 4. The two surface mining methods refer to the basic way overburden is stripped from the coal, and not to how coal is excavated.

Changes in Recoverable Coal Reserves

Table 5 lists the changes between recoverable coal reserves as presented in Report ER 79-9 and this report. A discussion of the changes follows.

Almost all of Nova Scotia's coal reserves are located in the Sydney Coalfield. The Donkin-Morien Project of the Cape Breton Development Corporation has provided a major addition to Nova Scotia's recoverable coal reserves. A significant drop has occurred in New Brunswick's Minto Coalfield reserves because of a more stringent definition of what constitutes a coal reserve. There are prospects of developing additional reserves from the existing resource base in the Minto Coalfield and from the Beersville coalfield to the northeast.

Feasibility studies of the Onakawana lignite deposit in Ontario, south of James Bay, have postponed further development of this low rank coal for electric power generation.

New data on the extensive lignite deposits in southern Saskatchwan are not available, so the recoverable coal reserves for Saskatchewan are those presented in Report ER 79-9, less production from 1978 to 1981, inclusive. Currently, the coal reserves of southern Saskatchewan are being reassessed by CANMET.

Because of the more stringent definition of what constitutes a recoverable coal reserve the tonnage figures for Alberta Plains coal have dropped significantly. It must be emphasized this in no way signals a decrease in Alberta's coal resource base, or its potential for further development. For reasons explained in both Report ER 79-9 and in this report, coal resource and reserve terms adopted by Alberta's Energy Resources Conservation Board and those used by EMR are quite different and not easily comparable.

Major coal developments since 1978, in the Peace River, Elk Valley, Crowsnest and Hat Creek coalfields in British Columbia have placed tonnages in these deposits into the coal reserve category, thereby adding significantly to recoverable coal tonnages in that province. Currently there are no plans to develop the Hat Creek deposit.

LIST OF COAL MINE OPERATORS, 1983

Table 6 lists coal mine operators, by province and by coalfield as of 1983 in a format similar to that used in the former "Operators List 4: Coal Mines in Canada" (7). Figure 3 to Figure 6 show locations of mine operations.

Since the publication of the last Operators List in January 1979 there has been a surge of new coal developments followed by a recession in coal markets. Besides major expansions to production capacity in several established mining operations, seven new coal mines have come on stream and others are under construction. New mines since 1978 are the Poplar River Mine in Saskatchewan, the Paintearth and Gregg River Mines in Alberta and the Line Creek, Greenhills, Bullmoose and Quintette Mines in British Columbia.

Also within the past five years two long-established underground coal operations in Alberta closed because coal remaining in these properties was no longer considered by the mine operators to be economically recoverable. The underground operations of Coleman Collieries Ltd. in the Crowsnest Pass area closed in March 1979 and operations at the Canmore Mines Ltd. located at the eastern entrance to Banff National Park closed in July 1979. The Canmore Mines first produced coal in 1888, primarily to fuel the steam engines hauling along the newly-constructed CPR trans-mountain railway line.

OPERATING STATISTICS

Operating data presented in Tables 7 to 11 are in a format comparable to that used in former issues of "Operators List 4: Coal Mines in Canada" so that comparable statistics are maintained.

SOURCES OF INFORMATION AND ACKNOWLEDGEMENTS

The approval of coal projects in Alberta and British Columbia follows well-defined procedures (8,9) which have resulted in some public disclosure of data on coal reserve quantities, limiting criteria, coal quality, mining plans, environmental impact assessments etc. In this regard the writers wish to acknowledge assistance in accessing public documents held in the Coal Department of Alberta's Energy Resources Conservation Board and the Mineral Resources Branch of B.C.'s Ministry of Energy, Mines and Petroleum Resources. As well, the authors wish to thank the managers of various coal mining operations and developments across Canada who, without exception, have permitted field trips to their mine properties.

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APPENDIX A

EMR'S COAL RESOURCE CLASSIFICATON
(essentially from Report ER 79-9)

A meaningful reporting of Canada's coal resources must be made in the context of a classification scheme that takes into account the great diversity of the nation's coal deposits. The coal resource classification scheme classifies the resources according to two basic considerations: (a) the assurance of their existence and (b) the feasibility of exploitation. Each of these considerations is subdivided into categories having defined parameters. The definitions of terms and parameters used in this scheme are given below. They are somewhat similar to those used in the United States (Averitt, 1969) but are modified to suit local conditions that are present in Canadian coal deposits.

Definition of Resource Terms

COAL RESOURCES

The term "coal resources" is defined as the coal that is contained in seams occurring within specified limits of thickness and depth from surface.

ASSURANCE OF EXISTENCE

The terms "measured", "indicated", "inferred" and "speculative" denote the level of confidence with which given quantities of resources have been determined or estimated; they are defined as follows:

Measured Resources are resources for which tonnages are computed from information revealed in outcrops, trenches, mine workings and boreholes. The spacing of points of observation necessary to justify confidence in the character and continuity of coal seams differs from region to region according to the character of the deposits and the geological conditions. In general the points of observation should be separated by less than the following distances:

Coal regions in Canada	Maximum distance between points of observation (in metres)
Cordillera*	300
(150 m in severely contorted areas)	
Plains	
Alberta	800
Saskatchewan	800
New Brunswick	400
Nova Scotia	
Sydney Coalfield, offshore	
Harbour and Phalen seams	1 600
Other seams	800
Sydney Coalfield, onshore	800
Other coalfields	300

*Cordillera region includes all British Columbia and the Foothills and Mountain regions of Alberta.

Indicated Resources are resources for which tonnages are computed partly from specific measurements and partly from reasonable geological projections. For the general coal regions in Canada, the points of observation should be separated by less than the following distances:

Coal regions in Canada	Maximum distance between points of observation (in metres)
Cordillera	600
(300 m in severely contorted areas)	
Plains	
Alberta	1 600
Saskatchewan	1 600
New Brunswick	800
Nova Scotia	
Sydney Coalfield, offshore	
Harbour and Phalen seams ..	4 800
Other seams	1 600
Sydney Coalfield, onshore ...	1 600
Other coalfields	600

Inferred Resources are resources for which quantity estimates are based largely on a broad knowledge of the geologic character of the bed or region and for which few measurements of seam thickness are available. The estimates are based primarily on an assumed continuity of coal seams in areas remote from the points of observation used to calculate measured or indicated resources.

Speculative Resources are resources for which quantity estimates are based on information from a few scattered occurrences. Resources of this description are mainly in frontier areas where coal mining or exploration have not taken place.

FUTURE CONSIDERATION

It is realized that it would be more meaningful to express the assurance of existence (level of confidence) by a range of possible error rather than by an arbitrary spacing of the points of observation. As an example, a measured resource estimate might be stated to have a level of confidence to within plus or minus 10 percent. To achieve this requires complex analysis.

FEASIBILITY OF EXPLOITATION

Resources of Immediate Interest consist of coal seams that, because of favourable combinations of thickness, quality, depth and location, are considered to be of immediate interest for exploration or exploitation activities. The conditions set out below do not apply rigorously in each case, but they give a general indication of thickness and depth of coal seams included in this category. In all cases, coal beds are included that are thinner or deeper than listed below but are nonetheless being mined at this time.

Cordillera:	Coal of all ranks in beds at least 1.5 m thick that can be surface-mined.
	Anthracitic and bituminous coal seams at least 1.5 m thick to a depth of 300 m, that are too deep for surface mining but might be mined underground.
Plains: (Alberta and Saskatchewan)	Bituminous and subbituminous coal beds at least 1.5 m thick to a depth of 230 m. Lignite seams at least 1.5 m thick that can be surface-mined (generally to depths less than 45 m).
New Brunswick:	Seams at least 0.4 m to a depth of 24 m.
Nova Scotia: Offshore:	Seams at least one metre thick to a depth of 1 200 m.

Nova Scotia:

Onshore: Seams at least 0.5 m thick to depths of 45 m and all seams at least one metre thick to depth of 1 200 m.

Resources of Future Interest consist of coal seams that, because of less favourable combinations of thickness, quality, depth and location, are not of immediate interest but may become of interest in the foreseeable future. The following limits are applied (excluding the resources of immediate interest described above):

Cordillera: Seams at least 1.5 m thick to depths of 750 m.

Plains: (Alberta and Saskatchewan) Seams at least one metre thick to depths of 450 m.

Nova Scotia:

Offshore: Seams at least one metre thick with depths in excess of 1 200 m.

Onshore: Seams at least one metre thick with depths in excess of 1 200 m.

FUTURE CONSIDERATIONS

When new mining technologies and/or changing economic conditions have indicated the possibility of mining thinner or deeper seams, or seams that are otherwise currently excluded from the estimates, it may become necessary to change the parameters for determining the feasibility of exploitation so as to include these coals in the estimates.

APPENDIX B

EMR'S COAL RESERVE CLASSIFICATION
(essentially from Report ER 79-9)

The terminology used in this report is similar to that given in Report ER 79-9, excepting that "mineable coal" has been replaced by the term COAL IN MINEABLE SEAMS.

COAL IN MINEABLE SEAMS is that part of measured and indicated resources of immediate interest that can be considered for mining using current technology and economics, before there is any allowance for mining losses. To qualify as COAL IN MINEABLE SEAMS the following conditions must apply:

- that feasibility studies have been done, specific plans for mining method and processing (if needed) have been adopted and the overall economic feasibility for developing the coal deposit appears favourable.
- that the necessary infrastructure (townsite, power and transportation facilities) is either in place or can be amortized through coal sales.
- that the coal is legally accessible for excavation i.e. the development considered is beyond the prospectus or initial disclosure stage in the regulatory process and has received approval-in-principle from the provincial government concerned with controlling development.
- that all coal being considered for development is likely to be marketable at minimum acceptable profit levels.

RECOVERABLE COAL is that part of COAL IN MINEABLE SEAMS that would be recoverable as run-of-mine or raw coal, making allowances for mining losses. For example, in surface mining, a portion of the top of a seam will likely be lost with overburden in the stripping operation, or a part of the seam next to the spoil pile will not likely be excavated. In underground operations the most common mining loss is associated with pillars left as supports or barriers.

CLEAN COAL is that part of RECOVERABLE COAL that remains as the prime saleable product after upgrading in a preparation plant.

SALEABLE COAL is coal that meets saleable specifications; it may be clean coal with acceptable moisture content or raw coal that is ready to be used without further upgrading. Saleable coal differs from CLEAN COAL in that its quantity includes losses in shipment and, in most instances, moisture added in processing.

Table 2 — Estimates of coal reserves in Canada (1982) in megatonnes
(for EMR definition of resource/reserve terminology see Appendices "A" and "B")

Province	Coalfield	*Coal rank	Coal in mineable seams	Recoverable coal	Clean coal
NOVA SCOTIA	Cumberland-Springhill	hvb	0.1+	0.1+	NA
	Inverness	hvb	2.8	1.4	NA
	Pictou	hvb	0.2	0.1	NA
	Sydney	hvb	809.0	443.0	339
	TOTAL		812.1	444.6	339
NEW BRUNSWICK	Minto	hvb	5.8	5.7	NA
	Beersville	hvb	13.6	12.2	NA
	TOTAL		19.4	17.9	NA
ONTARIO	Onakawana	lig	0	0	NA
SASKATCHEWAN	Estevan	lig			NA
	Willow Bunch	lig			NA
	Wood Mountain	lig	2 121	1 697	NA
	Cypress	lig			NA
	TOTAL		2 121	1 697	NA
ALBERTA PLAINS	Alix	sub	4.2	2.9	NA
	Ardley	sub	1.8	1.5	NA
	Battle River	sub	148	90	NA
	Drumheller	sub	41.9	10.5	NA
	Mayerthorpe	sub	3.1	2.0	NA
	Morinville	sub	12.7	8.3	NA
	Red Deer	sub	6.0	4.4	NA
	Sheerness	sub	170	126	NA
	Thorhild-Abee	lig	1.6	1.2	NA
	Tofield-Dodds	sub	1.3	1.0	NA
	Wabamun	sub	675	518	NA
	Wetaskiwin	sub	249.7	154.6	NA
	TOTAL		1 315	918	NA
ALBERTA FOOTHILLS	Coalspur	hvb	153	125	70
	Obed Mountain	hvb	188	147	91
	TOTAL		341	272	161
ALBERTA MOUNTAINS	Cadomin-Luscar	mvb	182	91	70
	Canmore	lvb	NA	NA	NA
	Coleman	mvb	NA	NA	NA
	Smoky River	lvb	422	163	117
	Tent Mountain	mvb	NA	NA	NA
	TOTAL		604	254	187
BRITISH COLUMBIA	Comox	hvb	16	15	10
	Crowsnest	lvb-mvb	596	472	397
	Elk Valley	lvb-mvb	1 166	1 102	735
	Flathead	lvb-mvb	NA	NA	NA
	Hat Creek	lig-sub	739	566	NA
	Peace River	mvb	759	509	357

*lig = lignitic; sub = subbituminous; lvb = low volatile bituminous; mvb = medium volatile bituminous; hvb = high volatile bituminous.

Table 3 — Coal reserves in Canada, by rank (1982)

Rank Region Coalfield	Coal in mineable seams (megatonnes)	Recoverable coal (megatonnes)	Recoverable coal heating value (petajoules)
LIGNITIC			
Saskatchewan			
All coalfields	2 121	1 697	23 800
British Columbia			
Hat Creek	739	566	6 800
Sub-Total, Lignitic	2 860	2 263	30 600
SUBBITUMINOUS			
Alberta			
Alix	4	3	50
Battle River	148	90	1 800
Drumheller	42	10	200
Morinville	13	8	100
Red Deer	6	4	100
Sheerness	170	126	2 100
Wabamun	675	518	9 800
Wetaskiwin	250	155	2 900
Others	6	4	100
Sub-Total, Subbituminous	1 314	918	17 150
BITUMINOUS			
Nova Scotia			
Sydney	809	443	12 000
Others	3	2	50
New Brunswick			
Minto	5.8	5.7	150
Beersville	13.6	12.2	350
Alberta			
Coalspur	153	125	2 600
Obed Mountain	188	147	2 800
Cadomin Luscar	182	91	2 500
Smoky River	422	163	4 600
British Columbia			
Comox	16	15	400
Crowsnest	596	472	11 800
Elk Valley	1 166	1 102	27 500
Peace River	759	509	12 700
Sub-Total, Bituminous	4 313	3 087	77 450
TOTAL, All Ranks	-	-	125 200
BITUMINOUS METALLURGICAL, included in BITUMINOUS above			
Nova Scotia	243	133	
Alberta	604	254	
British Columbia	2 201	1 643	
TOTAL, Metallurgical	3 048	2 030	

Table 4 — Coal reserves in Canada, by likely mining method (1982)
(in megatonnes)

Rank Province Coalfield	Recoverable coal	Surface methods		Underground methods		
		shovel/ truck	dragline	longwall	room & pillar	hydraulic
LIGNITIC						
Saskatchewan						
All coalfields	1 697		1 697			
British Columbia						
Hat Creek	566	566				
Sub-Total, Lignitic	2 263	566	1 697			
SUBBITUMINOUS						
Alberta						
Battle River	90		90			
Drumheller	10			10		
Sheerness	126		126			
Wabamun	518		518			
Wetaskiwin	155		155			
Others	16	16				
Sub-Total, Subbituminous	915	16	889	10		
BITUMINOUS						
Nova Scotia						
Cumberland-Springhill	0.1	0.1				
Inverness	1.4				1.4	
Pictou	0.1				0.1	
Sydney	443			443		
New Brunswick						
Minto	5.7		5.7			
Beersville	12.2		12.2			
Alberta						
Coalspur	125	84	22	18	1	
Obed Mountain	147	47	100			
Cadomin-Luscar	91	72			9	10
Smoky River	163	95			68	
British Columbia						
Comox	15	6	9			
Crowsnest	472	402			2	68
Elk Valley	1 102	1 089	13			
Peace River	509	423			86	
Sub-Total, Bituminous	3 087	2 218	162	461	168	78
TOTAL, by Basic Method		Surface: 5 548		Underground: 717		
TOTAL, by Mining Method		2 800	2 748	471	168	78

Table 5 — Changes in recoverable coal reserves

Province/ Region	Recoverable coal reserves ($x10^6$t)			Remarks
	Report ER 79-9	This report	Difference	
Nova Scotia	89	445	+356	Donkin-Morien Project has added $212x10^6$ tonnes recoverable coal.
New Brunswick	33	18	−15	more stringent definition of coal reserves; resource base unchanged.
Ontario	NA	0	–	
Saskatchewan	1 720	1 697	−23	no new data; coal produced from 1978-81 deducted from previous total; currently being reassessed.
Alberta Plains	2 182	918	-1 264	more stringent definition of reserves; resource base actually increased per Report ERCB 83-31(6).
Alberta Foothills	239	272	+33	
Alberta Mountains	291	254	−37	more stringent definition of reserves; resource base unchanged.
British Columbia				
bituminous	955	2 098	+1 143	major projects added; more coal considered recoverable from Hat Creek Project although there are no plans to develop this coal.
lignitic	397	566	+169	
Canada Total: lig	2 117	2 263	+146	no new data on Saskatchewan lignite; increase in Hat Creek reserves.
sub	2 182	918	−1 264	more stringent definition of reserves; resource base increased.
bit	1 607	3 087	+1 480	major new developments in B.C. and N.S.
BITUMINOUS METALLURGICAL, included in BUTUMINOUS above				
Nova Scotia	69	133	+64	
Alberta	290	254	−36	
British Columbia	904	1 643	+739	
Total, Metallurgical	1 263	2 030	+767	

Table 6 — Coal Mine Operators, 1983

Mine Operator & Head Office	Mine Name, Location & Representative	Basic Mine Type	1983 Mine Output 1977 (preliminary)	No. of Employees	Major Markets
NOVA SCOTIA					
SYDNEY COALFIELD					
Cape Breton Development Corporation P.O. Box 2500 Sydney, N.S. B1P 6K9	Lingan Colliery Lingan, N.S. E. Durdle - Colliery General Manager	underground (submarine)	1 633	staff 65 others 1 190	metallurgical coal for local and export markets; thermal coal for export and local electric power generation
	No. 26 Colliery Glace Bay, N.S. W. LeBlanc - Colliery General Manager	underground (submarine)	886	staff 67 others 1 176	metallurgical coal for local and export markets; thermal coal for export and local electric power generation
	Prince Colliery Point Aconi, N.S. T. Baldwin - Colliery General Manager	underground (submarine)	782	staff 43 others 529	thermal coal for electric power generation locally and in other parts of N.S.
Selminco Joint Venture P.O. Box 189 New Waterford, N.S. B1H 4N9	Princess Coal Reclamation Project Sydney Mines, N.S. C. McCormack - Project Manager	reclamation of old mine waste dumps	56	staff 5 others 29	local thermal coal market
	Summit Coal Reclamation Project New Waterford, N.S. G. Potter - Project Manager	reclamation of old mine waste dumps	68	staff 6 others 29	local thermal coal market
NOVACO Ltd. P.O. Box 147 Sydney Mines, N.S. B1V 1Y3	Point Aconi Pit Sydney Mines, N.S. John C. Smith President	surface	215	staff 3 others 40	local electric power generation
Thomas Brogan & Sons Construction Ltd. 131 Main Street Sydney Mines, N.S.	Point Aconi Pit Sydney Mines, N.S. Thomas Brogan - Manager	surface	34	staff 2 others 16	local electric power generation
INVERNESS COALFIELD					
Evans Coal Mines Ltd. R.R. 1 Inverness County, N.S. B0E 1N0	St. Rose Mine Margaree Harbour Gary Evans - Manager	underground	43	staff 6 others 54	local domestic and electric power generation
NEW BRUNSWICK					
MINTO COALFIELD N.B. Coal Ltd. P.O. Box 520 Minto, N.B. E0E 1J0	Minto/Chipman Area Pits A. Cormier - President	surface	510	staff 10 others 205	electric power generation in N.B.

Coal Rank and Seam(s)	Mining Method & Major Equipment	Coal Preparation Facilities	Remarks
high volatile A bituminous; Harbour Seam; 2.1 m thick; dips 9° but varies from 5° to 10° seaward	advancing longwalls plus room-and-pillar section (Lingan A); 4 shearer faces with powered roof supports; 7 roadway cutter loaders 4 ranging arm double drum shearers 2 continuous miners 2 shuttle cars 2 roof bolters	Victoria Junction Coal Preparation Plant (1976); coal crushed to -38 mm processed thru heavy medium cyclones and froth flotation cells in separate streams for each of Lingan and No. 26 Collieries; in addition to met. coal, plant produces a middling product for thermal market; feed capacity - 755 tonnes/hr.	room-and-pillar coal shipped directly to thermal power plant 3 advancing longwalls operating
high volatile A bituminous; Harbour Seam; 2.1 m thick; dip varies from 5° to 10° seaward	advancing longwalls; 3 shearer faces with powered roof supports; 2 roadway cutter loaders 3 other loaders 3 ranging arm double drum shearers	run-of-mine coal to rotary breaker at pithead prior to movement by rail to Victoria Junction Preparation Plant	2 advancing longwalls operating
high volatile A bituminous; Hub Seam; 2.25 m thick; dip about 3°	retreating longwalls; 2 shearer faces with powered roof supports; 13 roadway cutter loaders	run-of-mine coal moved by truck directly to power generating plants	1 retreating longwall operating
high volatile A bituminous; discard mostly from former Harbour Seam underground operations	plant feed excavated by frontend loader and trucked to prep. plant	Princess Recovery Plant (1980) includes conditioner/breaker, water cyclones and dewatering screens; capacity 81 tonnes/hr.	plant designed to produce 59 000 tonnes coal/annum from 400 000 tonnes feed
high volatile A bituminous; discard mostly from former Harbour and Phalen Seam underground operations	plant feed excavated by frontend loader or backhoe and trucked to prep. plant	Summit Recovery Plant (1982) includes conditioner/breaker, water cyclones and dewatering screens; capacity 91 tonnes/hr.	plant designed to produce 68 000 tonnes coal/annum from 440 000 tonnes feed
high volatile A bituminous; Harbour Seam; (also locally called Sydney Main Seam) 0.8 m thick dips 4° to 5°	primarily dragline stripping; some bulldozer stripping 1 dragline 9.2 m^3 or 11.5 m^3 2 bulldozers 1 rotary drill 8 haulage trucks of 27.2 tonnes	run-of-mine coal delivered directly to power generating plant	60% of overburden blasted
high volatile A bituminous; two seams each 0.9 m thick; near level	tractor and dragline stripping; 1 dragline 5.3 m^3 6 bulldozers 3 frontend loaders 6.9 m^3, 6.1 m^3 and 3.8 m^3	run-of-mine coal delivered directly to power generating plant	
high volatile B bituminous; No. 5 Seam 2.4 m thick; dips 16°	room-and-pillar; multiple simultaneous blasting and slusher loading	mechanical dry screening; capacity 72 tonnes/hr.	production expansion underway
high volatile A bituminous; single seam; 0.3 to 0.5 m thick; flat	dragline stripping; five draglines with bucket capacities of 49.7 m^3, 9.2 m^3, 12.2 m^3, 9.9 m^3 and 4.6 m^3; 6 bulldozers 7 loaders 5 rotary drills 31 haulage trucks of 13.6 tonnes 2 haulage trucks of 27.2 tonnes	washer & thermal dryer; 136 tonnes/hr. capacity	

Mine Operator & Head Office	Mine Name, Location & Representative	Basic Mine Type	1983 Mine Output 10^3T (preliminary)	No. of Employees	Major Markets
SASKATCHEWAN					
ESTEVAN COALFIELD					
Bienfait Coal Co., c/o Luscar Ltd. 800 Royal Trust Tower Edmonton, Alberta T5J 2Z2	Bienfait Mine Bienfait, Sask. S. Kingdon - Mine Manager	surface	1 210	staff: 25 others: 80	electric power generation both locally and for Manitoba and Ontario; lignitic char produced for barbeque briquettes
Manitoba and Saskatchewan Coal Co. Ltd. c/o Luscar Ltd. 800 Royal Trust Tower Edmonton, Alberta T5J 2Z2	Boundary Dam Mine Estevan, Sask. A. Dowhaniuk - Mine Manager	surface	1 202	staff: 13 others: 43	local electric power generating plant
Manalta Coal Ltd. P.O. Box 2880 Calgary, Alberta T2P 2M7	Costello Mine (prior to Aug./82 was named Klimax Mine) Estevan, Sask. H. Boles - Mine Manager	surface	468	staff: 12 others: 20	local electric power generation and domestic heating; industrial uses in Sask. and Manitoba
	Utility Mine Estevan, Sask. W. Kelly - Mine Manager	surface	2 402	staff: 19 others: 61	local electric power generation
Saskatchewan Power Corp. 2025 Victoria Ave. Regina, Sask. S4P 0S1	Souris Valley Mine Estevan, Sask. C. G. Langonberger - Mine Manager	surface	144	staff: 4 others: 26	local electric power generation
WILLOW BUNCH COALFIELD					
Saskatchewan Power Corp. 2025 Victoria Ave. Regina, Sask. S4P 0S1	Poplar River Mine Coronach, Sask. R. O. Mickleborough - Mine Manager	surface	2 334	staff: 17 others: 120	local electric power generation
ALBERTA'S PLAINS REGION					
BATTLE RIVER COALFIELD					
Forestburg Collieries Ltd. c/o Luscar Ltd. 800 Royal Trust Tower Edmonton, Alberta T5J 2Z2	Diplomat Mine Forestburg, Alberta O. Saboe - Mine Manager	surface in Western Canada	344	staff: 6 others: 20	local electric power generation; industrial and domestic markets
	Paintearth Mine Forestburg, Alberta O. Saboe - General Manager	surface	1 272	staff: 14 others: 60	local electric power generation

Coal Rank and Seam(s)	Mining Method & Major Equipment	Coal Preparation Facilities	Remarks
lignitic A; single seam in Estevan Zone is 6.4 m thick includes two partings totalling 1.2 m; near horizontal	dragline stripping; 1 dragline 53.6 m^3 1 dragline 8.4 m^3 1 coal power shovel 6.1 m^3 1 frontend loader 4.6 m^3 8 haulage trucks 55 tonnes 1 rotary drill 8 bulldozers	screening plant only	employees working in calciner not included
lignitic A; single seam in Estevan Zone is 3.5 m thick with parting of variable thickness up to 1.8 m; near horizontal	dragline stripping; 1 dragline 30.6 m^3 1 dragline 8.4 m^3 1 dragline 5.4 m^3 1 coal power shovel 7.7 m^3 6 haulage trucks 64 tonnes 1 rotary drill 4 bulldozers	crushing and screening done at local power generating plant	
lignitic A; two seams totalling 2.5 m in Estevan Zone separated by parting up to 1.5 m; near horizontal	dragline stripping; 1 dragline 48 m^3 1 coal power shovel 12 m^3 1 frontend loader 5.3 m^3 6 haulage trucks 64 tonnes 2 bulldozers	mine tipple has capacity of 600 tonnes/hr	
lignitic A; one seam in Estevan Zone 3.8 m with parting up to 0.3 m; near horizontal	dragline stripping; 1 dragline 69 m^3 1 dragline 26 m^3 1 coal power shovel 12 m^3 1 coal hydraulic shovel 12 m^3 6 haulage trucks 91 tonnes 2 bulldozers	crushing and screening at power plant; capacity 1 000 tonnes/hr	Sask. Power Corp. is mine owner
lignitic A; one seam from 3.0-4.3 m in Estevan Zone, includes a parting from 0.6-1.2 m thick; near horizontal	dragline stripping; 1 dragline 5.7 m^3 1 coal power shovel 3.8 m^3 3 haulage trucks 45.4 tonnes 3 bulldozers	crushing and screening at local power plant	mine closed summer, 1983
lignitic A; Hart Seam is 3.0-4.3 m thick with a parting up to 1.4 m thick; near horizontal	dragline stripping; 2 draglines 69 m^3 1 coal power shovel 12 m^3 1 coal loading backhoe 12 m^3 4 haulage trucks 136 tonnes 4 bulldozers 1 frontend loader 12.2 m^3	crushing and screening at mine tipple; capacity 1 200 tonnes/hr	dewatering required prior to mining
subbituminous C; Horseshoe Canyon Formation; one seam 1.2 m thick; near horizontal	dragline stripping; 1 dragline 8.4 m^3 1 coal power shovel 7.7 m^3 2 coal power shovels 6.1 m^3 4 haulage trucks 54 tonnes 2 bulldozers 1 frontend loader 7.6 m^3	some crushing and screening at mine tipple; capacity 225 tonnes/hr	
subbituminous C; Horseshoe Canyon Formation; two seams of aggregate thickness to 4.5 m with parting up to 1.5 m; near horizontal	dragline stripping; 1 dragline 52 m^3 4 haulage trucks 120 tonnes 2 frontend loaders 9.9 m^3 2 bulldozers	crushing and screening at local power plant	

Mine Operator & Head Office	Mine Name, Location & Representative	Basic Mine Type	1983 Mine Output 10^3T (preliminary)	No. of Employees	Major Markets
BATTLE RIVER COALFIELD continued					
Manalta Coal Ltd. P.O. Box 2880 Calgary, Alberta T2P 2M7	Vesta Mine Halkirk, Alberta L. W. Repka - Mine Manager	surface	1 129	staff: 17 others: 43	local electric power generation
SHEERNESS COALFIELD					
Manalta Coal Ltd. P.O. Box 2880 Calgary, Alberta T2P 2M7	Montgomery Mine (prior to Dec. 82 was named Roselyn Mine) D. L. Meads - Mine Manager	surface	94	staff: 4 others: 15	local domestic uses and electric power generation; some industrial markets
WABAMUN COALFIELD					
Manalta Coal Ltd. P.O. Box 2880 Calgary, Alberta T2P 2M7	Highvale Mine Seba Beach, Alberta I. J. Wiens - Mine Manager	surface	9 597	staff: 60 others: 300	local electric power generation
	Whitewood Mine Wabamun, Alberta G. G. Dirk - Mine Manager	surface	1 994	staff: 23 others: 90	local electric power generation
ALBERTA'S FOOTHILLS REGION COALSPUR COALFIELD					
Luscar Ltd. 800 Royal Trust Tower Edmonton, Alberta T5J 2Z2	Coal Valley Mine Edson, Alberta P. M. Bowman - General Manager	surface	3 568	staff: 85 others: 375	electric power generation in Ontario and thermal coal export markets
	Coal Valley Mine Silkstone Pit (as above)	underground	116	staff: N/A others: N/A (see remarks)	(as above)
ALBERTA'S MOUNTAIN REGION CADOMIN-LUSCAR COALFIELD					
Cardinal River Coals Ltd. c/o Luscar Ltd. 800 Royal Trust Tower Edmonton, Alberta T5J 2Z2	Luscar Mine Hinton, Alberta R. Morin - Mine Manager	surface	2 856	staff: 105 others: 450 (see remarks)	metallurgical coal primarily for export market

Coal Rank and Seam(s)	Mining Method & Major Equipment	Coal Preparation Facilities	Remarks
subbituminous C; three seams No. 1, 2 and 3 of thickness up to 3.0 m, and 2 partings up to 2.0 m; near horizontal	dragline stripping; 1 dragline 44.4 m^3 1 coal power shovel 8 m^3 1 coal power shovel 4 m^3 6 haulage trucks 64 tonnes 3 bulldozers	crushing and screening at mine tipple, capacity 2 000 tonnes/hr.	
subbituminous C; two seams: Main Seam 2.4 m thick and Top Seam 0.3 m to 0.6 m thick occurs 1.2 m above Main; near horizontal	bulldozer/scraper stripping; 2 bulldozers 1 coal power shovel 5.7 m^3 2 frontend loaders 5.0 m^3 6 haulage trucks 45 tonnes	crushing and screening at mine tipple, capacity 230 tonnes/hr.	
subbituminous B; up to five seams being mined in coal zone (Lower Ardley Unit) varying in thickness from 9.3-11.3 m of which 8.5 m is coal; near horizontal	dragline stripping; 1 dragline 44 m^3 1 dragline 38 m^3 1 dragline 23 m^3 5 coal power shovels 12 m^3 4 haulage trucks 145 tonnes 4 haulage trucks 136 tonnes 5 haulage trucks 91 tonnes 12 bulldozers 1 tractor-mounted drill 1 frontend loader 12 m^3	crushing and screening at mine tipple; capacity 2 700 tonnes/hr.	TransAlta Utilities Corp. is mine owner
subbituminous B; up to six seams being mined in a coal zone (Lower Ardley Unit) of average cumulative thickness 7.3 m; near horizontal	dragline stripping; 1 dragline 46 m^3 1 dragline 25 m^3 1 coal power shovel 6 m^3 1 coal power shovel 4 m^3 6 haulage trucks 64 tonnes 1 frontend loader 5.7 m^3 4 bulldozers	crushing and screening at mine tipple; capacity 1 100 tonnes/hr.	TransAlta Utilities Corp. is mine owner
high volatile C/B bituminous; three of five seams are mineable; Val D'Or Seam (up to 10.7 m, including partings) Upper Silkstone Seam (up to 3.7 m) and Mynheer Seam (up to 9.1 m,including partings); variable dips due to folding/faulting	basic stripping with shovel-truck units and draglines; selective stripping with hydraulic excavators and scrapers; 1 dragline 32.0 m^3 1 dragline 10.9 m^3 1 power shovel 11.5 m^3 1 power shovel 6.9 m^3 2 backhoes 5.4 m^3 1 rotary drill 6 haulage trucks 154 tonnes 14 haulage trucks 91 tonnes 13 bulldozers	prep. plant (1978) has coarse fraction cleaned in heavy medium drum separator; medium-sized fraction in heavy medium cyclones and fine fraction in classifying and compound water-only cyclones; clean coal dried by belt press filters and fluid bed dryer fired by both coal and gas; feed capacity: 720 tonnes/hr.	
high volatile B bituminous; Upper Silkstone Seam (up to 3.7 m); dips 10°	room-and-pillar; continuous miner 2 shuttle cars	(as above)	operation shutdown June/83
medium volatile bituminous; Jewel Seam approx. 10 m thick but varies with folding; minor rider seams present; dip variable beacuase of folding	shovel-truck stripping; 1 power shovel 23.0 m^3 4 power shovels 11.5 m^3 1 dragline (for coal) 3.8 m^3 18 haulage trucks 154 tonnes 17 haulage trucks 91 tonnes 6 frontend loaders 5 rotary drills 11 bulldozers	prep. plant (1970, major expansion 1980) has coarse fraction washed in heavy medium cyclones; fine fraction treated in compound water cyclones, screens and froth flotation cells;coal dried in coal-fired fluid bed dryers; feed capacity 600 tonnes/hr.	pre. plant employees included

Mine Operator & Head Office	Mine Name, Location & Representative	Basic Mine Type	1983 Mine Output 10^3T (preliminary)	No. of Employees	Major Markets
CADOMIN-LUSCAR COALFIELD continued					
Gregg River Resources Ltd. c/o Manalta Coal Ltd. P.O. Box 2880 Calgary, Alberta T2P 2M7	Gregg River Mine Hinton, Alberta H. L. Jensen - Mine Manager	surface	263 thermal 1 066 met.	staff others } 300 total	metallurgical and some thermal coal for export market
SMOKY RIVER COALFIELD					
Smoky River Coals Ltd. c/o McIntyre Mines Ltd. 355 4th Ave. S.W. Calgary, Alberta T2P 0J3	Mine 1774 Grande Cache, Alberta K. Forgaard - Vice-President & General Manager	surface	1 480 met. 80 thermal	staff: 37 others: 205	metallurgical coal for export market and some thermal coal for local power generation
	Mines 1765/09/A,B,G (as above)	underground	744 met.	staff: 28 others: 133	(as above)
TENT MOUNTAIN/ COLEMAN COALFIELDS					
Coleman Collieries Ltd. c/o Norcen Energy Resources Ltd. 715 5th Ave. S.W. Calgary, Alberta T2P 2X7	Coal Reclamation Project Coleman, Alberta W. A. Loucks - President	reclamation of old mine waste dumps	186	staff: 14 others: 75	thermal coal export market
BRITISH COLUMBIA CROWSNEST COALFIELD					
Byron Creek Collieries Ltd. c/o Esso Minerals Canada Ltd. 237 - 4th Ave. S.W. Calgary, Alberta T2P 0H6	Coal Mountain Mine (formerly Corbin Mine) Sparwood, B.C. J. Aiello - General Manager	surface	1 146	staff: 64 others: 135	thermal coal for domestic (Ontario) and export markets
Westar Mining Ltd. 1176 W. Georgia St. Vancouver, B.C. V6E 4B8	Harmer Surface Mine Sparwood, B.C. L. W. Riffel - General Manager	surface	5 676	(both mines) staff: 165 others: 875	metallurgical coal for export market
	Michel Underground Mine Sparwood, B.C. B. Hart - General Superintendent of Underground Mines	underground	969		(as above)
ELK VALLEY COALFIELD					
Fording Coal Ltd. 200, 205 9th Avenue S.E. Calgary, Alberta T2G 0R4	Fording River Mine Elkford, B.C. J. G. Gardiner - Vice-President and General Manager	surface	4 866	staff: 300 others: 1 047	metallurgical coal for export market

Coal Rank and Seam(s)	Mining Method & Major Equipment	Coal Preparation Facilities	Remarks
medium volatile bituminous; Jewel Seam 10 m thick with thickening in synclinal troughs; dip variable	shovel-truck stripping; 1 hydraulic excavator 17 m^3 4 power shovels 23 m^3 4 frontend loaders 14 m^3 8 haulage trucks 110 tonnes 13 haulage trucks 155 tonnes 6 bulldozers	in prep. plant (1983) coarse fraction washed in heavy medium bath; medium fraction cleaned in heavy medium cyclones and fine fraction in compound water cyclones; coal dried in coal-fired fluid bed dryer; feed capacity 600 tonnes/hr.	
low volatile butuminous; Seam #4 (6.1 m thick but ranges from 4.3-7.9 m); Seam #10 (2.7 m thick but ranges from 1.9-6.0 m); Seam #11 (3.0 m thick, but ranges from 1.2-4.0 m); dip variable	shovel-truck stripping; 5 power shovels 11.5 m^3 24 haulage trucks 134 tonnes 9 haulage trucks 76 tonnes 5 coal trucks 45 tonnes 3 frontend loaders 10m^3 3 rotary drills 7 bulldozers	prep. plant (1969) has coarse fraction cleaned in heavy medium cyclones; fine fraction cleaned in froth flotation cells; coal product dried in natural gas-fired fluid bed dryer; feed capaci ty 590 tonnes/hr	
Seam #4 as above; dip varies from near level up to 14°	room-and-pillar; 8 continuous miners 12 shuttle cars 12 roof bolters	(as above)	
medium volatile bituminous; discard from former mostly u/g met. coal mines	1 frontend loader 10.7 m^3 1 frontend loader 6.9 m^3 3 haulage trucks 77 tonnes 3 haulage trucks 59 tonnes 3 bulldozers	prep. plant uses jig, shaking tables and water only cyclones; coal dried with gas-fired fluid bed dryer; feed capacity 225 tonnes/hr	operations completed Oct. 83; treated 675,000 tonnes discard to produce 186,000 tonnes coal
medium volatile bituminous; No. 1 Seam has highly variable thickness from a few metres up to some 60 m and higher in certain faulted and folded areas	shovel-truck stripping; 1 hydraulic shovel 14.5 m^3 4 frontend loaders 9 m^3 2 frontend loaders 6 m^3 13 haulage trucks 77 tonnes 5 haulage trucks 109 tonnes 5 haulage trucks 32 tonnes 2 rotary drills 6 bulldozers	in prep. plant (1978) coarse and fine coal fractions are separated, coarse coal cleaned in a five-cell jig and dewatered, then recombined with fine coal; dried mechanically; feed capacity 330 tonnes/hr.	
low to medium volatile bituminous; essentially one seam called 10 Seam; thickness from 12 to 15 m; dip varies from 18° to 55° but mostly in range of 20°	shovel-truck stripping; 4 power shovels 19 m^3 4 power shovels 11 m^3 1 power shovel 23 m^3 22 haulage trucks 180 tonnes 23 haulage trucks 154 tonnes 18 haulage trucks 90 tonnes 1 haulage truck 320 tonnes 1 frontend loader 27 m^3 4 frontend loaders 17 m^3 9 rotary drills 12 bulldozers	Elkview Coal Prep. Plant (1970, expanded in 1972) has two streams; coarse coal cleaned in heavy medium vessels and middle-sized fraction in heavy medium cyclones; fine coal cleaned in two stages of water cyclones, vibrating sieve bands and froth flotation cells; fine coal dried in fluid bed dryer; feed capacity 1 600 tonnes/hr.	prior to June, 1983 Westar Mining Ltd. was named B.C. Coal Ltd. prior to Oct. 1980 B.C. Coal Ltd. was named Kaiser Resources Ltd.
as above, except dip in hydraulic mining section ranges in order of 35° whereas room-and-pillar section dip is 10° to 15°	most u/g coal produced by hydraulic mining, remainder by room-and-pillar; 4 hydraulic monitors 7 continuous miners	(as above)	(as above)
primarily low volatile, but also medium and high volatile bituminous; up to 11 seams mined, ranging in thickness from 1.5-11 m; dip varies with regional synclinal structures but generally in the range 20° to 25°	shovel-truck stripping on both Eagle Mountain and Greenhills sides plus dragline stripping on Greenhills side; 3 shovels 23 m^3 5shovels 11.5 m^3 1 dragline 45.8 m^3 1 dragline 3.8 m^3 41 haulage trucks 154 tonnes 21 haulage trucks 108 tonnes 5 frontend loaders 11.5 m^3 8 rotary drills 25 bulldozers	prep. plant (1972) has two streams; coarse coal cleaned in vertical wheel separators and middle-sized fraction in heavy medium cyclones; fine coal has water only cyclones and froth flotation cells; clean coal dryers are gas-fired; feed capacity 1 200 tonnes/hr.	

Mine Operator & Head Office	Mine Name, Location & Representative	Basic Mine Type	1983 Mine Output 10^3T (preliminary)	No. of Employees	Major Markets
ELK VALLEY COALFIELD continued					
Westar Mining Ltd 1176 W. Georgia St. Vancouver, B.C. V6E 4B8	Greenhills Mine Elkford, B.C. L. J. Lindsay - General Manager	surface	1 264	staff: 95 others: 225	primarily met. coal for export market as well as thermal coal for export
Crows Nest Resources Ltd c/o Shell Canada Resources 525 Third Ave. S.W. Calgary, Albert a T2P 2M7	Line Creek Mine Sparwood, B.C. R. A. Rouleau - Vice President and General Manager	surface	2 040	staff: 60 others: 347	metallurgical and thermal coal export markets
PEACE RIVER COALFIELD					
Teck Corporation 1199 W. Hastings St. Vancouver, B.C. V6E 2K5	Bullmoose Mine Tumbler Ridge, B.C. M. Lipkewich - Mine Manager	surface	200	approx. 400	metallurgical and thermal coal export markets
Denison Mines Ltd Coal Division 650 W. Georgia St. Vancouver, B.C. V6B 4N7	Quinette Mine Tumbler Ridge, B.C. W. E. Draper - Mine Manager	surface	1 500	approx. 930	metallurgical and thermal coal export markets

Coal Rank and Seam(s)	Mining Method & Major Equipment	Coal Preparation Facilities	Remarks
medium and high volatile bituminous; of some 14 seams in mine area Seams Nos. 1, 7, 10 & 16 provide 80% of recoverable coal and range in thickness from 5-11 m; dip varies in synclinal structures from 20° to 60°	shovel-truck stripping; 3 hydraulic shovels 14 m^3 2 frontend loaders 21 m^3 1 frontend loader 17 m^3 1 frontend loader 10 m^3 14 haulage trucks 90 tonnes 3 rotary drills 4 bulldozers	prep. plant (1983) has two streams: coarse coal cleaned in heavy medium cyclones; fine size cleaned in two-stage water only cyclones, two-stage sieve bends and froth flotation cells; clean coal dryers are gas-fired; feed capacity currently approx. 500 tonnes/hr.	prior to June, 1983 Westar Mining Ltd. was named B.C. Coal Ltd. prior to Oct. 1980, B.C. Coal Ltd. was named Kaiser Resources Ltd.
low and medium volatile bituminous; four of 7 seams in mine area have 90% of reserves; thickness 3 m to 13 m; dips range 35° to 45°	shovel-truck stripping; 2 power shovels 11.5 m^3 1 power shovel 14 m^3 2 hydraulic excavators 3.4 m^3 1 hydraulic excavator 5.6 m^3 2 frontend loaders 11.5 m^3 8 haulage trucks 109 tonnes 10 haulage trucks 77 tonnes 16 haulage trucks 40 tonnes 3 rotary drills 6 bulldozers	separate met. and thermal coal prep. plants; in thermal prep. plant coarse fraction is dry screened, then cleaned in two-product heavy medium bath; fine coal is mechanically dewatered; combined coal product is mechanically dried; feed capacity 275 tonnes/hr. in met. prep. plant coarse fraction treated in heavy medium cyclones; fine coal cleaned in two-stage water cyclones and froth flotation cells; clean coal dryers are gas-fired; feed capacity 375 tonnes/hr.	
medium volatile bituminous; five seams with thickness between 1.4 m and 4.8 m, totalling about 13 m; dip 5° to 7°	shovel-truck stripping; 3 power shovels 12.5 m^3 2 hydraulic excavators 12.0 m^3 18 haulage trucks 110 tonnes 2 frontend loaders 4 m^3 1 frontend loader 9 m^3 1 frontend loader 11.5 m^3 3 rotary drills 5 bulldozers	in prep. plant (1983) coarse coal fraction is cleaned in heavy medium cyclones; fine coal fraction has three stages of cleaning utilizing two-stage water cyclones and froth flotation cells; clean coal is dried in coal-fired fluid bed dryer; feed capacity 450 tonnes/hr.	production started in 1983
medium volatile bituminous; between four and six seams to be mined in various pits with aggregate thicknesses between 17 m & 19 m; dips within synclinal folds in range 15° to 30°	shovel-truck stripping; 6 power shovels 23 m^3 3 hydraulic shovels 14 m^3 3 frontend loaders 11 m^3 14 haulage trucks 154 tonnes 5 haulage trucks 77 tonnes 7 drills 11 bulldozers	prep. plant (1983) has two met. coal circuits each of 600 tonnes/hr. feed capacity and one thermal coal circuit of 350 tonnes/hr. feed capacity; four cleaning processes used; heavy medium drum heavy medium cyclones, water-only washing cyclones and froth flotation cells	production started in 1983

Table 7 — Coal production[1] and value by rank and by province, 1979-1983

	1979		1980		1981		1982		1983	
	'000 Tonnes	'$000	'000 Tonnes	'$000	'000 Tonnes	'$000	'000 Tonnes	'$000	'000 Tonnes	'$000
BITUMINOUS										
Nova Scotia	2 157	99 675	2 726	133 245	2 539	128 450	3 051	166 263	3 000	146 700
New Brunswick	310	10 310	439	16 880	524	21 600	499	24 573	500	28 900
Alberta	5 529	192 195	6 852	245 970	6 895	246 400	6 978	301 018	7 200	341 200
British Columbia	10 616	488 135	10 156	445 430	11 781	540 800	11 768	619 900	11 800	570 400
TOTAL	18 612	790 315	20 173	841 525	21 739	937 250	22 296	1 111 754	22 550	1 087 200
SUB-BITUMINOUS										
Alberta	9 575	45 990	10 544	56 240	11 551	79 350	13 021	108 772	14 200	121 200
LIGNITIC										
Saskatchewan	5 013	23 695	5 971	34 235	6 798	55 900	7 494	73 950	7 500	91 600
ALL TYPES - CANADA TOTAL	33 200	860 000	36 688	932 000	40 088	1 072 500	42 811	1 294 476	44 250	1 300 000

Sources: Statistics Canada and Department of Energy, Mines and Resources
[1]Production represents clean coal output plus raw coal sales from mines with preparation plants, plus raw coal shipments where there is no preparation plant at the mine.

Table 8 — Coal production[1] by rank, province and type of mining

	1979		1980		1981		1982		1983	
	U/G	Surface	U/G	Surface	U/G	Surface	U/G	Surface	U/G	Surface
BITUMINOUS										
Nova Scotia	2 492	41	2 975	117	2 748	237	3 297	326	3 320	249
New Brunswick	-	335	-	452	-	518	-	498	-	550
Alberta	1 310	6 550	1 062	8 510	965	8 716	881	9 167	861	9 313
British Columbia	846	13 593	703	13 466	1 069	14 423	1 076	16 206	969	16 646
TOTAL	4 648	20 519	4 760	22 545	4 782	23 894	5 254	26 197	5 150	26 758
SUB-BITUMINOUS										
Alberta	16	9 559	-	10 544	-	11 551	-	13 021	-	14 465
LIGNITIC										
Saskatchewan	-	5 013	-	5 971	-	6 798	-	7 494	-	7 500
CANADA	4 664	35 091	4 760	39 060	4 782	42 244	5 254	46 712	5 150	48 723
CANADA TOTAL (ALL MINES)	39 755		43 820		47 026		51 966		53 873	

Sources: Statistics Canada and Department of Energy, Mines and Resources
[1]Raw coal production only.

Table 9 — Average number of employees[1] in Canadian coal mines, by province 1970-1982

Year	Nova Scotia	New Brunswick	Saskatchewan	Alberta	B.C. & Yukon	Canada Total
1970	3 653	302	166	1 654	1 188	6 963
1971	3 319	199	180	2 068	1 418	7 184
1972	3 695	210	172	1 890	1 944	7 911
1973	3 573	201	190	1 644	2 174	7 782
1974	3 392	218	204	1 655	2 444	7 913
1975	2 947	238	210	2 120	2 793	8 308
1976	3 493	236	283	2 445	2 539	8 996
1977	3 812	247	314	2 494	2 914	9 781
1978	3 995	244	366	2 756	3 253	10 574
1979	3 623	224	320	2 607	3 495	10 269
1980	3 857	264	397	3 218	3 680	11 416
1981	3 748	285	491	2 854	3 804	11 182
1982	4 623	273	430	2 866	4 921	13 113

Sources: Statistics Canada and Department of Energy, Mines and Resources.
[1]Production and related employees in mines and preparation plants plus executives, administrative and office staff at the mines.

Table 10 — Productivity in coal mining, by province and by type of mining, 1982

	Production (raw) ('000 Tonnes)			Production Saleable ('000) Tonnes)	Manpower				Productivity (raw coal output per person year)			Productivity Overall Saleable Coal Output per person year
					Mining Related		Others	Total				
	Surf	U/G	Total		Surf	U/G			Surf	U/G	Overall	
Nova Scotia	326	3 297	3 623	3 051	536	2 615	1 472	4 623	608	1 261	784	660
New Brunswick	498	-	498	498	198	-	75	273	2 515	-	1 824	1 824
Saskatchewan	7 494	-	7 494	7 494	306	-	124	430	24 490	-	17 428	17 428
Alberta	22 188	881	23 069	19 713	1 341	206	1 319	2 866	16 546	4 277	8 049	6 878
British Columbia	16 206	1 076	17 282	11 768	2 811	349	1 761	4 921	5 765	3 083	3 512	2 391
Canada	46 712	5 254	51 966	42 524	5 192	3 170	4 751	13 113	8 997	1 657	3 963	3 243

Surf = surface mines

U/G = underground mines

Table 11a — Producer's disposition of saleable coal[1], 1979
('000 tonnes)

Destination	Originating Province					
	N.S.	N.B.	SASK.	ALTA.	B.C. & YUKON	CANADA
Railways in Canada	-	-	-	-	-	-
Newfoundland	2	-	-	-	-	2
Prince Edward Island	13	-	-	-	-	13
Nova Scotia	1 398	3	-	77	-	1 478
New Brunswick	57	187	-	-	-	244
Quebec	56	120	-	135	-	311
Ontario	449	-	81	1 407	668	2 605
Manitoba	-	-	263	24	46	333
Saskatchewan	-	-	4 639	162	-	4 801
Alberta	-	-	-	9 373	-	9 373
British Columbia	-	-	-	6	225	231
TOTAL CANADA	1 975	310	4 983	11 184	939	19 391
United States	-	-	29	6	-	35
Japan	-	-	-	2 784	7 796	10 580
Others	499	-	-	824	1 720	3 043
TOTAL SHIPMENTS	499		29	3 614	9 516	13 658

Sources: Statistics Canada and Department of Energy, Mines and Resources.
[1]Saleable Coal: raw coal, clean coal and middlings.

Table 11b — Producer's disposition of saleable coal[1], 1980
('000 tonnes)

Destination	Originating Province					
	N.S.	N.B.	SASK.	ALTA.	B.C. & YUKON	CANADA
Railways in Canada	-	-	-	-	-	-
Newfoundland	2	-	-	-	-	2
Prince Edward Island	11	-	-	-	-	11
Nova Scotia	1 954	1	-	121	-	2 076
New Brunswick	61	419	-	-	-	480
Quebec	36	19	-	-	-	55
Ontario	100	-	84	1 630	551	2 365
Manitoba	-	-	440	8	60	508
Saskatchewan	-	-	5 446	103	-	5 549
Alberta	-	-	-	10 682	-	10 682
British Columbia	-	-	-	6	184	190
TOTAL CANADA	2 164	439	5 970	12 550	795	21 918
United States	-	-	-	-	1	1
Japan	-	-	-	3 545	7 669	11 214
Others	547	-	-	1 165	2 352	4 064
TOTAL SHIPMENTS	547	-	-	4 710	10 022	15 279

Sources: Statistics Canada and Department of Energy, Mines and Resources.
[1]Saleable Coal: raw coal, clean coal and middlings.

Table 11c — Producer's disposition of saleable coal[1], 1981
('000 tonnes)

Destination	Originating Province					
	N.S.	N.B.	SASK.	ALTA.	B.C. & YUKON	CANADA
Railways in Canada	-	-	-	-	-	-
Newfoundland	2	-	-	-	-	2
Prince Edward Island	8	-	-	-	-	8
Nova Scotia	1 777	-	-	103	-	1 880
New Brunswick	46	524	-	-	-	570
Quebec	8	-	-	-	-	8
Ontario	-	-	604	1 744	268	2 616
Manitoba	-	-	612	36	39	687
Saskatchewan	-	-	5 582	67	-	5 649
Alberta	-	-	-	11 734	1	11 735
British Columbia	-	-	-	8	207	215
TOTAL CANADA	1 841	524	6 798	13 692	515	23 370
United States	-	-	-	-	45	45
Japan	-	-	-	3 022	7 460	10 482
Others	579	-	-	1 116	3 621	5 316
TOTAL SHIPMENTS	579	-	-	4 138	11 126	15 843

Sources: Statistics Canada and Department of Energy, Mines and Resources.
[1]Saleable Coal: raw coal, clean coal and middlings.

Table 11d — Producer's disposition of saleable coal[1], 1982
('000 tonnes)

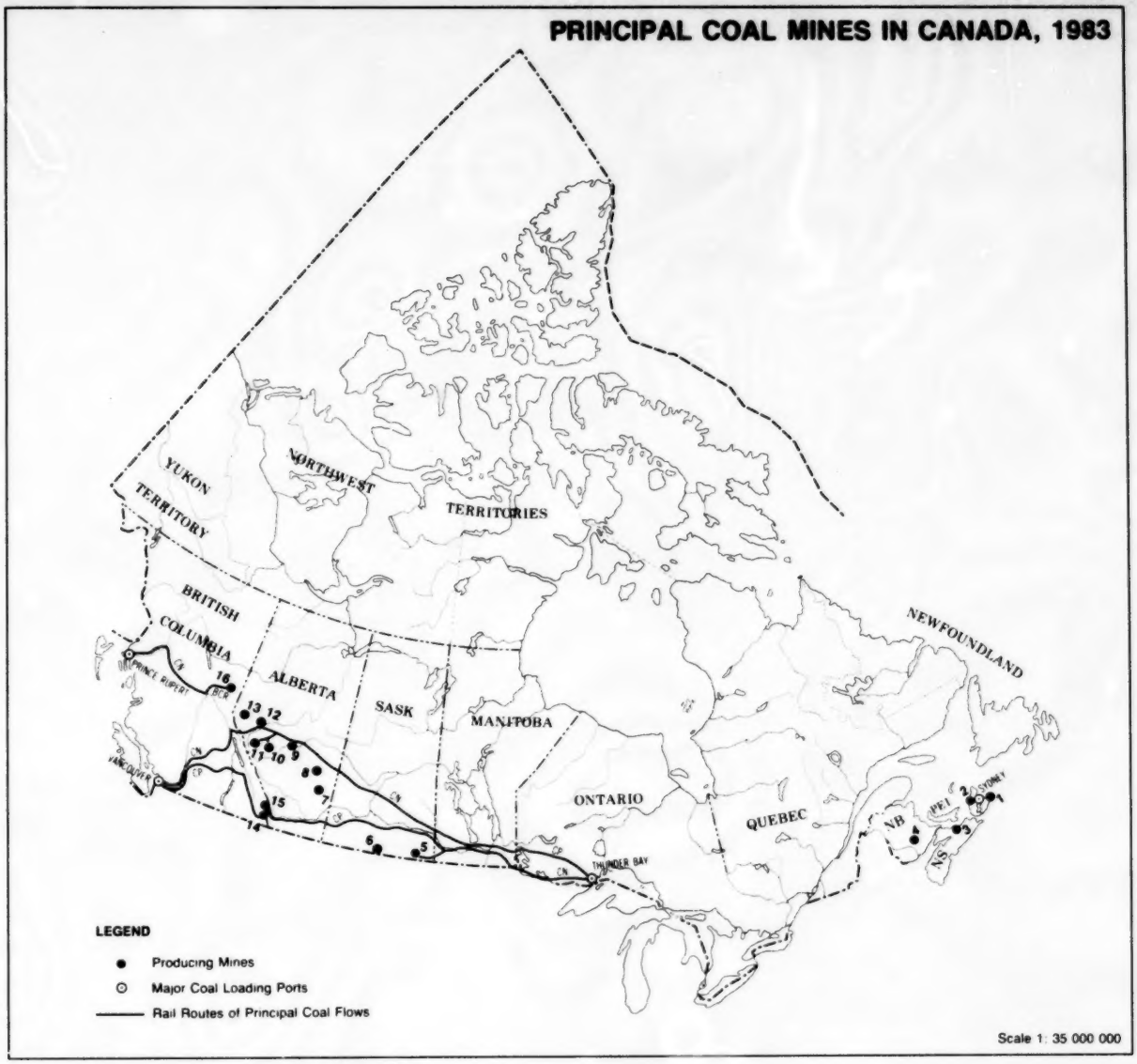
Destination	Originating Province					
	N.S.	N.B.	SASK.	ALTA.	B.C. & YUKON	CANADA
Railways in Canada	-	-	-	-	-	-
Newfoundland	2	-	-	-	-	2
Prince Edward Island	17	-	-	-	-	17
Nova Scotia	1 856	-	-	-	-	1 856
New Brunswick	29	499	-	-	-	528
Quebec	-	-	-	-	-	-
Ontario	-	-	1 000	1 495	588	3 083
Manitoba	-	-	325	7	50	382
Saskatchewan	-	-	6 170	26	-	6 196
Alberta	-	-	-	13 024	-	13 024
British Columbia	-	-	-	6	66	72
TOTAL CANADA	1 904	499	7 495	14 558	704	25 360
United States	-	-	-	4	66	70
Japan	-	-	-	4 165	6 622	10 787
Others	1 050	-	-	887	3 599	5 536
TOTAL SHIPMENTS	1 050	-	-	5 056	10 287	16 393

Sources: Statistics Canada and Department of Energy, Mines and Resources.
[1]Saleable Coal: raw coal, clean coal and middlings.

Table 11e — Producer's disposition of saleable coal[1], 1983 P
('000 tonnes)

Destination	Originating Province					
	N.S.	N.B.	SASK.	ALTA.	B.C. & YUKON	CANADA
Railways in Canada	-	-	-	-	-	-
Newfoundland	1	-	-	-	-	1
Prince Edward Island	13	-	-	-	-	13
Nova Scotia	1 943	-	-	-	-	1 943
New Brunswick	4	573	-	-	-	577
Quebec	31	-	-	-	-	31
Ontario	-	-	962	1 253	559	2 774
Manitoba	-	-	221	157	29	407
Saskatchewan	-	-	6 307	95	41	6 443
Alberta	-	-	-	14 228	1	14 229
British Columbia	-	-	-	1	70	71
TOTAL CANADA	1 992	573	7 490	15 734	700	26 489
United States	-	-	-	-	31	31
Japan	55	-	-	4 335	6 902	11 292
Others	1 026	-	-	710	3 853	5 589
TOTAL SHIPMENTS	1 081	-	-	5 045	10 786	16 912

Sources: Statistics Canada and Department of Energy, Mines and Resources.
[1]Saleable Coal: raw coal, clean coal and middlings.
P= Preliminary



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INDEX FOR MAP

Nova Scotia
(bituminous coal)

1. Lingan Mine (Cape Breton Development Corporation)
   No. 26 Colliery (Cape Breton Development Corporation)
   Prince Mine (Cape Breton Development Corporation)
   Point Aconi Pit (Novaco Ltd.)
2. St. Rose Mine (Evans Coal Mines Ltd.)
3. Drummond Mine (Drummond Coal Co.)

New Brunswick
(bituminous coal)

4. Minto / Chipman Area Pits (N. B. Coal Ltd.)

Saskatchewan
(lignitic coal)

5. Bienfait Mine (Bienfait Coal Co.)
   Boundary Dam Mine (M & S Coal Co.)
   Costello Mine (formerly Klimax Mine) (Manalta Coal Ltd.)
   Souris Valley Mine (Saskatchewan Power Corporation)
   Utility Mine (Saskatchewan Power Corporation, with Manalta as operator)
6. Poplar River Mine (Saskatchewan Power Corporation)

Alberta
(subbituminous coal)

7. Montgomery Mine (formerly Roselyn Mine) (Manalta Coal Ltd.)
8. Vesta Mine (Alberta Power Limited, with Manalta as operator)
   Diplomat Mine (Forestburg Collieries Ltd.)
   Paintearth Mine (Forestburg Collieries Ltd.)
9. Highvale Mine (TransAlta Utilities Corporation, with Manalta as operator
   Whitewood Mine (TransAlta Utilities Corporation, with Manalta as operator)

(bituminous coal)

10. Coal Valley Mine (Luscar Sterco Ltd.)
11. Luscar Mine (Cardinal River Coals Ltd.)
    Gregg River Mine (Manalta Coal Ltd.)
12. Obed-Marsh Project (Union Oil Company of Canada Limited)
13. No. 1765 Mine (underground) (Smoky River Coals Ltd.)
    No. 1774 Mine (surface) (Smoky River Coals Ltd.)

British Columbia
(bituminous coal)

14. Corbin Mine (Byron Creek Collieries Limited)
    Harmer Surface Mine (Westar Mining Ltd.)
    Michel Underground Mine (Westar Mining Ltd.)
15. Line Creek Mine (Crows Nest Resources Limited)
    Fording River Mine (Fording Coal Ltd.)
    Greenhills Mine (Westar Mining Ltd.)
16. Quintette Mine (Denison Mines Limited and others)
    Bullmoose Mine (Teck Corporation and others)

Figure 3

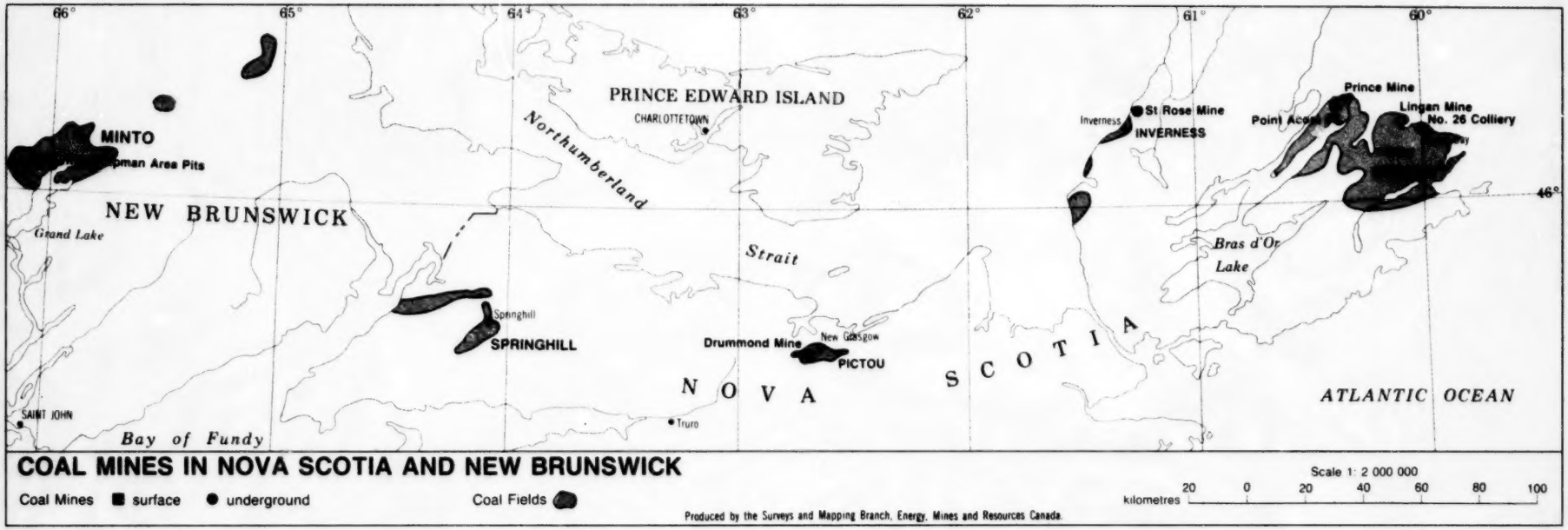
66°
65°
64°
63°
62°
61°
60°
46°
PRINCE EDWARD ISLAND
CHARLOTTETOWN
Northumberland
Strait
NEW BRUNSWICK
Grand Lake
MINTO
pman Area Pits
Springhill
SPRINGHILL
Drummond Mine
New Glasgow
PICTOU
Truro
Inverness
St Rose Mine
INVERNESS
Point Aconi
Prince Mine
Lingan Mine
No. 26 Colliery
Bras d'Or
Lake
N O V A S C O T I A
ATLANTIC OCEAN
SAINT JOHN
Bay of Fundy
COAL MINES IN NOVA SCOTIA AND NEW BRUNSWICK
Coal Mines surface underground
Coal Fields
Scale 1: 2 000 000
kilometres 20 0 20 40 60 80 100
Produced by the Surveys and Mapping Branch, Energy, Mines and Resources Canada.

Figure 4

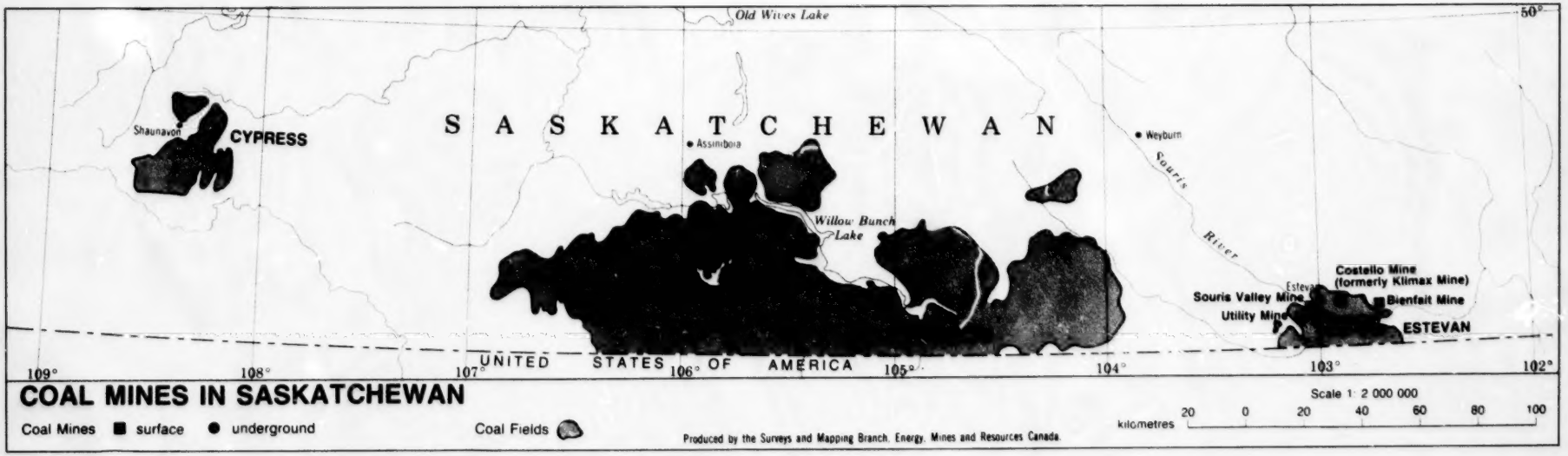
Old Wives Lake
50°
Shaunavon
CYPRESS
S A S K A T C H E W A N
Assiniboia
Weyburn
Souris River
Willow Bunch Lake
Costello Mine (formerly Klimax Mine)
Souris Valley Mine
Bienfait Mine
Utility Mine
ESTEVAN
UNITED STATES OF AMERICA
109°
108°
107°
106°
105°
104°
103°
102°
COAL MINES IN SASKATCHEWAN
Coal Mines surface underground
Coal Fields
Produced by the Surveys and Mapping Branch, Energy, Mines and Resources Canada.
Scale 1: 2 000 000
kilometres 20 0 20 40 60 80 100

Figure 5

COAL MINES IN ALBERTA AND BRITISH COLUMBIA

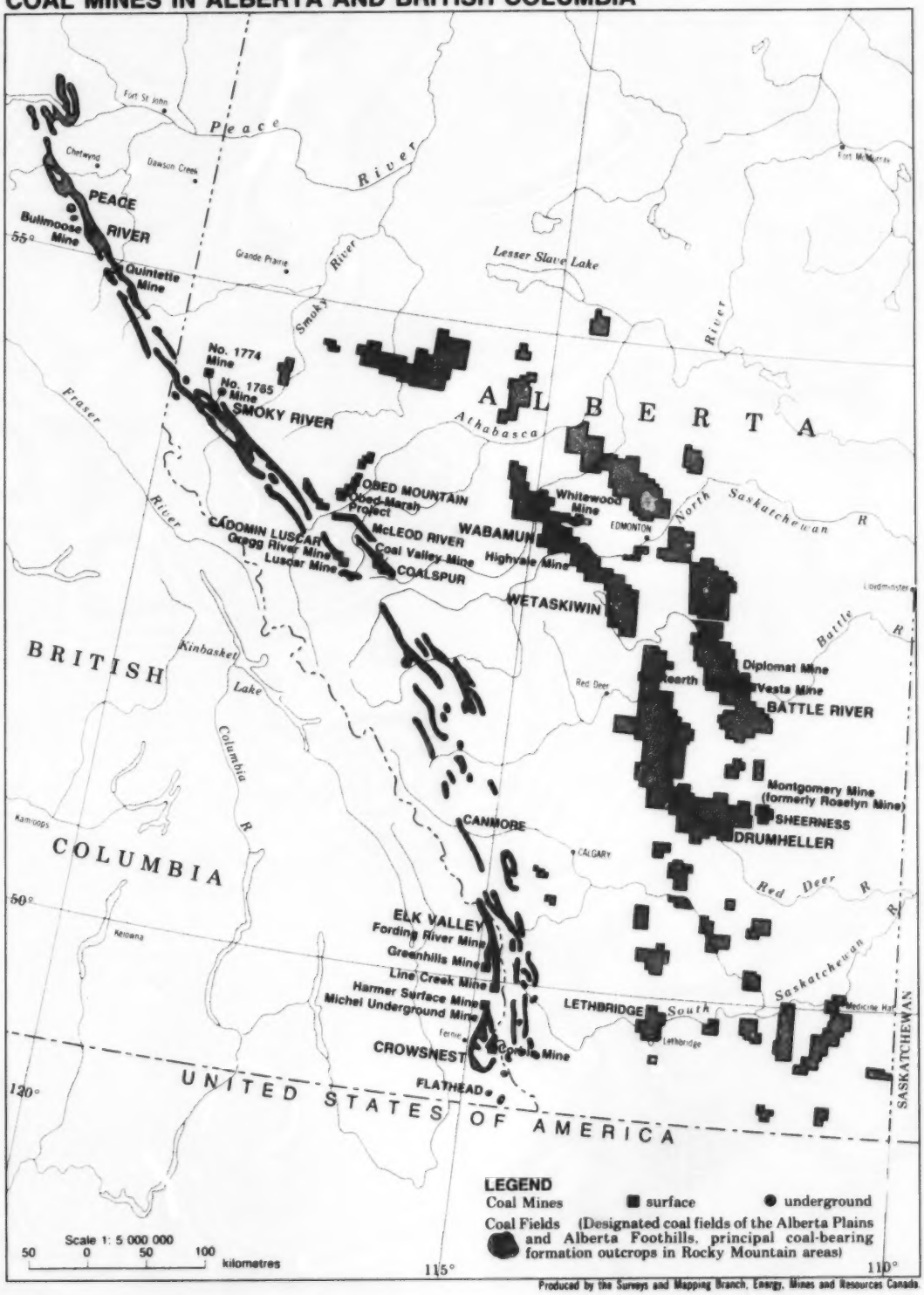

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Figure 6

— Notes —

— Notes —

OPINION POLL

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